

How to

REMODEL

a House



DALZELL • TOWNSEND



ATTRACTIVE HOME ACHIEVED THROUGH REMODELING

Courtesy of U. S. Gypsum Company, Chicago, Ill.



HOME AS IT APPEARED BEFORE REMODELING

Courtesy of U. S. Gypsum Company, Chicago, Ill.

How to

REMODEL

a House

**AN INTERESTING GUIDE FOR MAKING
THE PLANS, AND HOW TO CARRY THEM
OUT; INCLUDES EXAMPLE OF REMODELED
HOUSE WITH A COMPLETE SET OF BLUEPRINTS**

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ILLUSTRATED

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PREFACE

NOT only how to **do** it, but how to **plan** it. This, we decided, was the crying need in this fascinating business of remodeling old houses. A book that would give all people interested in remodeling, including the man and woman who live in a house that needs it, exact and practical information on how to proceed. From the preliminary thinking and planning—and most of the trouble starts, we believe, when there is not enough of this—to the final flick of the paint brush, this book tells you how to **plan** and how to **do**.

Of writings on remodeling there is no end. But we submit that a series of “before and after” photographs and plans, however intriguing, are not much help when it comes to knowing your bearing partitions, and whether or not the old house can take it.

Our book, on the other hand, guides you gently but firmly through every necessary process of reasoning, planning, and designing, not only by clear and careful explanations, but by illustrative examples. As a result, every step of your remodeling work is planned and proved before a single nail is driven.

It is our contention that much remodeling is poorly done solely because the people involved do not know how to plan for it **as a whole** and in sound relation to the existing structure.

Our book projects a method of determining whether the remodeling of any given house would be a worth-while economy and satisfaction. It presents a checklist of preliminary thinking and reasoning which you may apply to the house in question. It teaches you to visualize plans so clearly that you will omit no important consideration. It introduces a method of developing remodeling plans, by which the old house serves as a guide and check in the creation of the new plans. You learn to plan the remodeling of rooms by a method that is like playing with blocks; afterward you learn to fit these individual rooms into a harmonious whole.

Our book gives you a checklist method by which to plan the thrifty use of new materials in relation to the materials in the original house. We present studies in the evaluation of insulation, air-conditioning and heating plants, plumbing, and electric wiring, so that you may be guided by clear

principles, rather than by seductive sales literature, in these major considerations of equipment and design. Illustrative examples of these basic principles are given, so that the whole procedure, for layman as well as for mechanic and professional man, becomes intelligible rather than darkly mysterious.

All of our explanations and the illustrative material are based upon actual practical work. We have not been content to state abstract theory; the rules laid down for your guidance are based upon actual practice. The "how to do it" approach which we have employed successfully in so many other books is exemplified here. Every process involved in ordinary remodeling is thought through, planned, and checked, **with** you, so that you see clearly each step of each operation.

An illustrative example based on the general principles of the book shows every single step in the thinking, reasoning, and planning involved in remodeling an actual house.

A special feature is the set of full-sized blueprints at the back of the book, provided to deepen your understanding of the illustrative example.

Another and very useful feature is the comprehensive twenty-four-page index which makes any item of information available for instant reference. Besides enhancing its reference value for layman and student, this index gives the book the status of a handbook for contractor, carpenter, or mechanic.

The material in this book is applicable, whether you intend to remodel your house completely, or merely to modernize a room or two. It is ideal also, for long-term planning of remodeling that must be done piecemeal, as the budget concedes, but that must be planned as a whole if the end result is to be what you desire.

A mere casual reading of the book cannot fail to give the home owner a better sense of the problems and the exciting possibilities involved in remodeling. Further study will enable him to explain and present his ideas more clearly and creatively to his architect or builder. We believe the book is presented in such a fashion that by its use home owner and builder can see eye to eye and work together intelligently for the good of the house.

ACKNOWLEDGMENTS

SO comprehensive a book must come from many sources. We wanted to draw very freely from many, in order that the suggestions, rules, and principles, the explanations, and the illustrative examples would truly reflect, not only the view of authors and publisher, but also the ideas, principles, and procedures approved by the foremost authorities throughout the field.

To that end we called upon individuals, installation experts, material dealers, and manufacturers; we gratefully acknowledge the invaluable cooperation received from the following individuals and organizations:

James R. Abrams, Association of Gas Appliance and Equipment Manufacturers, New York City

American Savings & Loan Institute, Chicago, Illinois

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Better Homes & Gardens, Des Moines, Iowa

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The authors also take this means of extending their thanks to a host of other individuals and organizations, too numerous to list here. Throughout the text, a sincere effort has been made to acknowledge this cooperation.

The authors also express their appreciation to Carl H. Dunlap, of the American School, for his aid in preparing the chapter on electrical work; to James McKinney, of the American School, for his careful reading of the manuscript; and to A. E. Burke, Head of the Illustration Department, American Technical Society, for his excellent work on the illustrations.

J. RALPH DALZELL
GILBERT TOWNSEND

FOREWORD TO THE READER

WHAT THIS BOOK IS, AND HOW TO USE IT

ALTHOUGH this book was written in response to the tremendous interest encountered, we ourselves sometimes have been surprised at the extent and intensity of people's interest in the remodeling of houses.

We can think of many reasons for this interest, of course. First, the eternal dream of a home, planned to personal taste, and modern enough to provide the creature comforts that go with modern living. This dream is attained more often through remodeling, because in general it is cheaper than building anew.

Then, in many cities and towns the older residence sections are more attractive than the "Gardens" or "Developments" where the new houses are going up, in which streets are still to be paved, trees are wispy saplings, and lawns are rather raw and thin. Usually the older sections occupy the favored natural location; they are on the hill overlooking the town, or follow the river bank at its best, or fringe the lake shore. Also they are nearer to "downtown," to theaters, shops, and the more substantial office buildings. They are the really established centers of their communities, and a certain number of their inhabitants would not consider moving to the newer suburb additions. Attachment and association, as well as the mellow charm of streets and houses, would keep some of the people from making such a move, even if their finances would permit it. Yet they are not willing, either, to go on living without those comforts and conveniences which builders of newer houses are taking as a matter of course. Also their taste has outgrown a good deal of the "gingerbread" with which their fathers ornamented the family dwelling, and they recognize that many structural features of the house, even such things as the number and arrangement of the rooms, are rather out of step with modern living.

The answer to all or any of this, of course, is remodeling.

Remodeling has this advantage, also: You can go at it modestly, do it piecemeal, if necessary. If you build, you must build the whole house and equip it as well. But it is possible to make a long-term plan for your old house, and year by year remodel it a little nearer to the house of your dream.

These are some of the reasons, we think, for the widespread interest in

remodeling, plus the fact that it is a fascinating experience, a test of imagination and skill, and a lasting source of satisfaction. Many agencies and organizations now exist to make remodeling financially possible and easy.

So universal an interest, we feel, calls for something more than a manual of remodeling in precise textbook style, yet merits complete, technically correct, and thoughtful treatment. In this book, then, we have tried to make the friendly and somewhat informal instructions comprehensive, sound, and scientific, basing them on authoritative practice, and presenting them for the use of home owners, carpenters and other mechanics, young architects, and students of architectural design.

In text and illustrations, for example, the first chapter virtually constitutes a short course in architectural styles, teaching you how to recognize the common types of houses. Aside from its intrinsic interest, it is a vital unit of instruction in remodeling, since proper styling of a remodeled house is half the battle, and certainly essential to completely successful results.

Another chapter teaches you how to read and understand blueprints, giving complete instruction by which you learn the symbols and abbreviations—the alphabet of architectural plans—as well as the necessity of such plans, and their uses. This chapter is exact and comprehensive, yet not too involved or difficult for the layman to follow. The following chapter does the same thing for written specifications. It explains their function, as supplements to blueprints, and as authority in matters of materials, fixtures, makes or brands of equipment, and other details. It also clarifies the relation of specifications to contracts for remodeling work.

In Chapter IV, we consider what remodeling is, including the four degrees or classifications of it; and we learn how to decide whether or not remodeling in any given case would be worth while, how to outline our requirements, and how to finance the job. The preliminary thinking so essential to successful remodeling work is emphasized here. The chapter contains actual checklists of items demanding consideration, against which you can check every step of your own proposed remodeling. We believe this feature alone is invaluable, for it prevents you from making costly and troublesome omissions or errors in your own remodeling plans.

The book advises you, too, how to choose an architectural style to which your house might be adapted without costly and tedious changes. Also you learn how to choose a style that will not be out of place in the neighborhood or on the given lot; a house that will come nearest to meeting your individual requirements and tastes.

The book deals clearly and simply with architectural drawings, their functions, and the parts they play in planning, such as: a check on preconceived notions that might turn out to be impractical; a guide to a just rela-

tion between existing and proposed details; and a protection to owner and builder alike. Further, the chapter on the subject, Chapter VI, actually teaches you how to make these drawings.

Subsequent chapters take you further into the actual process of planning, one dealing with general structural details, another with a specific and complex detail, stairs. Technical considerations—the safe load of joists and rafters, their size and spacing, how to strengthen old joists, double framing, what to do about necessary cutting of framing members to accommodate pipes or ducts, what to do when it is necessary to remove a bearing partition—all of these are covered in Chapter VII. The chapter on stairs not only describes and illustrates types of stairs and details of their construction, but shows you how to design and locate them to the best advantage in the space available. An illustrative example takes you through every step in working out the problem of the stairway in a remodeled house.

An important chapter deals with insulation, in which we have tried to present a complete yet readable manual on this important feature of structural design. We explain what insulation is, its advantages in comfort, fuel saving, and fire resistance; we consider the various types of insulation; and we discuss how best to employ it in remodeling. The chapter also contains a technical study in calculation of heat losses and computation of fuel saved. This is authoritative, yet clear enough for anyone to read. We also discuss miscellaneous means of retarding heat loss, such as calking and weather stripping, and consider how to prevent condensation on and within walls in houses.

The book treats fully of materials, suggesting materials for each room, for floorings, interior and exterior walls, siding, finishes of all kinds, doors and windows, chimneys, fireplaces, foundations, gutters—in short, everything that might be used in remodeling a house. It also contributes valuable suggestions on combining old and new materials, preparing old materials to receive the new, and ways of salvaging as much as possible of the old.

One chapter is devoted to a comprehensive discussion on the remodeling and modernization of bathrooms—from the requirements of building codes and the relation of service pipes to floor joists and partitions, to the finished and elegant bathroom, whether newly added, or modernized from the old. The double-use bathroom, half bathroom, and modern powder room are described and illustrated. Another chapter deals in the same comprehensive way with kitchens, including an analysis of work centers, the planning to eliminate needless steps and increase efficiency, and a discussion of the various types of kitchen design, and units of equipment. "Before and after" illustrations are included to show what can be done. This chapter, too, is made clearer by the working out of an illustrative example.

In complete and technical detail one chapter of the book deals with

heating and air conditioning, including a discussion of all types of modern heating systems, fuels and automatic controls, and consideration of modern cooling methods. The chapter discusses the modernizing of old equipment, and, as illustrative example, carries out the full procedure for designing a mechanical furnace system for the house in the blueprints at the back of the book. Another chapter deals in similarly detailed fashion with the design of electrical wiring. This also includes an illustrative example in which we design the electrical wiring for this same house.

In Chapter XV we plan the remodeling of individual rooms, in relation to bearing partitions, joist strength and direction, location of doors and windows, size and shape of rooms, and their orientation and outlook. We use templates representing furniture as an aid to room design, with specific discussions on living room, dining room, bedrooms, recreation room, laundry, closets, and halls. This chapter also presents an illustrative example in which we design the individual rooms of an actual house. In the next chapter we design the floor plans and elevations of the same house, after consideration of such factors as structural economy in relation to changes in windows and doors, walls, floors and roofs, flues and chimneys, halls, closets, and stairs.

In conclusion, an illustrative example outlines completely the planning of an actual, typical remodeling job. In designing the remodeling of "the Jones house" we utilize the principles we have been learning throughout the book.

The blueprints in the envelope on the inside back cover of this book give in complete detail the "before and after" aspects of this house. Study of these two sets of blueprints alone would almost constitute a short course in remodeling.

Modernizing. Perhaps you are not remodeling your house completely, but only modernizing some portion of it. Then you would not need to study the entire book. For example, if you are modernizing a kitchen, Chapters II, III, IV, VI, VII, X, XII, and XIV are recommended reading. If you plan to convert your "parlor" into a modern living room, see Chapters II, III, IV, V, VI, VIII, XIV, and XV. A casual examination of the book will inform you what portions of it will fit your special needs.

Carpenters and Mechanics. Where mechanics are making the plans for remodeling, on the other hand, they will not need to spend much time on such chapters as II, III, VII, VIII, IX, and XIV. Their interest will lie in reviewing the necessary preliminary thinking, and in how to do the actual design work, especially as to certain troubling details, and the actual drawing of the plans.

Mechanics will find the book invaluable, however, to supplement and clarify the knowledge they have gained from experience in remodeling.

Also it will aid them in their promotional approach by showing them how to discover exactly what the owner has in mind, how to make the owner see what the remodeled house will be like, and why certain impractical demands cannot be met in the existing circumstances.

Young Architects. Young architects will find the book a splendid check on, and review of, the best theories—a very practical supplement to their naturally limited experience in remodeling. It will form a bridge between their theoretical and formal knowledge and the many special features peculiar to remodeling work.

In Schools. The book, we feel, will meet a real need as a supplementary text in any course in architectural design. We believe it will prove an excellent source of instruction in fundamentals of remodeling, structural details, material selection, selection and design of heating systems, electrical work, rooms, floor plans, and elevations.

The instructional material, though pointed toward remodeling, serves a general purpose as well. For example, Chapter II, on reading architectural plans, actually constitutes a thorough course in blueprint reading; Chapter VIII, on stairs, contains the essential instruction in the design of types of stairs common to residential building; and Chapter IX, on insulation, gives complete and authoritative instruction in that vital subject.

For use in schools, therefore, the book not only has much to offer as a supplementary text in all architectural courses, but also furnishes all the instruction necessary for conducting remodeling courses and for carrying on the actual planning of remodeling work.

So, to remodel a house.



DOUBLE-HUNG WINDOWS WITH MULLION BETWEEN AND FOLDING SHUTTERS
Courtesy of Curtis Companies, Incorporated, Manufacturers of Curtis Woodwork, Clinton, Iowa

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HOUSE IN NEW ENGLAND STYLE, WITH OVERHANGING SECOND STORY. COLONIAL ENTRANCE DOORWAY
Courtesy of Curtis Companies, Incorporated, Manufacturers of Curtis Woodwork, Clinton, Iowa

HOW TO REMODEL A HOUSE

CHAPTER I

Types of House Architecture

EVEN a little knowledge of architectural styles is a decided help to anyone who wants to plan the remodeling of a house, and being able to distinguish that one house is Dutch Colonial, another Cotswold, a third, Tudor, widens interest in one's surroundings.

This chapter is devoted to a study of the commonly used types of house architecture so that you may learn to recognize the various types and styles, and appreciate the details and characteristics that distinguish each of them.

GENERAL CLASSIFICATIONS. Most of the houses you see may be classified as either *traditional* or *modernistic*.

In the traditional class, and this includes by far the majority of houses, are types of architecture which have been in use for many years in America and in Europe. These are the types or styles which have been developed during various historical periods; in many cases they are named for the period in which they originated. The modernistic class, on the other hand, is the result of a movement started some years ago which cast aside all architectural traditions and limitations.

Traditional types and styles, as a whole, are of sufficient charm to have survived throughout the years, though today they are often designed with modifications to meet the requirements of modern living, new materials, and variations in building sites and in climate. In this class of houses, the exteriors conform to certain patterns or limitations, and the interiors must be designed in keeping with them.

On the other hand, in modernistic houses, the interiors are designed to suit the tastes and needs of the occupants, and the



exteriors are designed to fulfill these requirements as simply as possible. No embellishments are added out of respect for any traditional type. The exterior is regarded merely as a shell, or protection from the elements, and architectural effect is achieved by the skillful proportioning of the various wall areas, window locations, and like details.

Fig. 1 illustrates a typical modernistic house. Certainly it is radically different from the traditional styles with which we are familiar. The omission of pitched roofs, the large unadorned areas,



Fig. 1. Modernistic House
Courtesy of Portland Cement Association, Salt Lake City, Utah

corner windows, simple entrance, flat deck-like roofs, use of large areas of glass, and the irregular shape, all tend to make this type of house seem strange. However, there are many worth-while points in favor of this style, which more and more people are coming to recognize and accept.

In the following pages, various types within the traditional class are illustrated and explained, and a further discussion of the modernistic style is presented.

OLD ENGLISH OR COTSWOLD TYPE. This type of architecture comes from a region in England called *The Cotswold*. It dates back to the sixteenth century, in which period it was used in the design of country houses and farm cottages.

Fig. 2 shows a modern American house patterned after the Old English tradition. It will be seen that it is long and low in appearance, although it has two stories. The eaves of the sloping roofs are very

low, coming about to the level of the top of the first-floor windows. The roof has a considerable area, and the chimney is large.

Stone and stucco can be used to good advantage. Also, the walls can be designed using half-timber work, which gives the house even greater similarity to the original houses in England. Characteristics of this type are the rambling or spread-out design and the informal and inviting appearance. This is obtained, in part, by making the



Fig. 2. Old English or Cotswold House

floor plans unsymmetrical. These characteristics make the old English type especially adaptable to remodeling in which new rooms are added by building on a wing, such as that part of the house in Fig. 2 containing the chimney.

The fact that the windows are arranged in an informal manner also adds to the possibilities for remodeling this type of house. Many times when planning remodeling you find that it is impossible to arrange windows in any symmetrical manner. Therefore the use of a type that does not require this symmetry is a decided advantage.

The windows in Fig. 2 are both large and small. This is another remodeling advantage in the Old English type, since the greater or smaller size of a given window does not prevent its installation. The present-day trend is toward the use of more glass throughout houses. Large windows make even a small house seem larger, especially from

the interior; they provide more sunshine and in general make a house more agreeable to live in.

Because the eaves of this type of house are considerably lower than the ceilings of the second-story rooms, dormers and large dormer windows may be used successfully. Dormers should also be considered among the remodeling possibilities where second-floor rooms are desired in a house originally planned for one story. The sloping ceilings in second-story rooms often make it necessary to place the dormer windows in deep alcoves, which in some cases may reduce the amount of light. However, any such disadvantage is offset by the picturesque and home-like effect which these dormer windows lend to the exterior.

The low roofs have the effect of making the chimneys prominent. This adds to the old-world atmosphere, since, in the original houses of this style, chimneys were huge to accommodate the fireplaces which were used for both cooking and heating.

The use of small lights in the various windows, the use of random-colored shingles and stone, stucco, or half-timber walls, all make this not only a pleasing style of architecture but also a desirable one from the standpoint of remodeling. The effects shown in Fig. 2 can be obtained economically, and in keeping with typical remodeling requirements.

TUDOR TYPE. Prior to the time when the House of Tudor came to power in England, ceaseless internal wars caused many of the prominent and wealthy people to flee temporarily to France, where they acquired new ideas about many things, including architecture. When these people returned to England after the wars they brought their new ideas with them, and one of the effects can be noted in a style of architecture which they created. The houses they built after their return to England came to be known as Tudor houses. In them, the native Gothic styles were altered by French and Italian influence.

Fig. 3 shows a typical medium-sized house designed in the Tudor style.

The roof gables are prominent and the pitch rather high. This provides attic space and presents many possibilities for pleasing effects in exteriors.

Chimneys, as in the Cotswold type, are large and usually high. Pots are often placed on the tops of the chimneys, to enhance their appearance and add to the old-world atmosphere.

Exterior walls are generally made of stone, although brick and stucco also give pleasing results. In modern construction, veneer of brick or stone is often used with good effect. Heavy half-timber work can be employed successfully, also. In Fig. 3, timber work is used in the small entrance porch, in the gables, and in the dormers. Brick is used for window sills and to form part of the dormer walls.



Fig. 3. Tudor House

Windows are composed of small lights, which, in more expensive houses, may be leaded. It will be noted that the windows in this type are much smaller than in the Cotswold house. Casement-type windows give pleasing effects. If strictly accurate Tudor characteristics are desired, the mullions for the windows in more expensive houses can be made of stone.

This type does not have the rambling effect which is characteristic of the Cotswold house.

Usually the eaves are at second-floor ceiling level, although for the sake of economy they are sometimes built lower, as shown in Fig. 3. Shallow dormers and windows can be used to take away some of the formal appearance.

In remodeling a house to conform to the Tudor type, brick or stone veneer should be used in place of the solid masonry walls, unless, of course, the house to be remodeled was built with masonry walls originally. For this type of remodeling, the only possible additions are upward, as the plans must be symmetrical, rather than irregular as in the Cotswold style.

ENGLISH HALF-TIMBER TYPE. During the reign of Queen Elizabeth in England, expanding times promoted considerable building



Fig. 4. English Half-Timber House

activity, and a type of architecture known as English Half-Timber, sometimes called Elizabethan, became popular. This style is similar to the Tudor, but with certain characteristics emphasized. It is essentially an outgrowth of the Tudor type.

Fig. 4 shows a suburban house designed in accordance with the Half-Timber tradition. It has many of the characteristics of the Tudor type, such as prominent gables, small windows, large stone or masonry areas, large high chimneys, shallow dormers, and high-pitched roofs. Its appearance, however, is altered by the more extensive use of timber work.

Because of the greater use of half-timber work, this type of house can be more readily built of stucco or brick, if these materials are

cheaper than stone or brick veneers. The style adapts itself to remodeling better than the Tudor type, because wings, such as the one at the right end in Fig. 4, can be added to form two or more additional rooms, or a garage.

Other advantages of this type, from the standpoint of remodeling, are that rooms can be planned without so much regard for symmetrical appearance, windows need not be located in any formal manner, large or small gables may be used, and second stories may project out beyond first stories.

GEORGIAN TYPE. At about the time the American colonies broke away from English rule, a distinctly new type of architecture



Fig. 5. Georgian House

originated and was used as a basis of design both in England and in America. Known as the Georgian type, this style is notable for its wide departure from the Cotswold or the Tudor styles, being much more severe and formal in appearance. Fig. 5 shows a house designed after the Georgian tradition.

The style is symmetrical and formal. The general outline is rectangular and does not allow wings or the other rambling effects which are characteristic of the Cotswold and Tudor types.

Stone or brick is most often used for the exterior wall construction, depending upon which can be secured at the least expense.

Houses of the Georgian type are a full two stories in height, with either a low-hipped roof, or a high-pitched gable with dormers as attic windows. The cornice is usually heavy and highly ornamented.

The front entrance is at the center of the front elevation, and the windows of this elevation are located symmetrically in relation to the entrance. The second-floor windows are placed directly over those on the first floor. On other elevations the windows may be located with less exactness than at the front, although even then not a great deal of variation is allowed.

When the traditional Georgian type is followed in designing a house, there is a severe restriction in the arrangement of rooms, halls, and stairways. The window locations being so formally prescribed tends further to check the free arrangement of rooms. Central halls are required on both floors, in order to conform with the location of the entrance.

Because of this, the Georgian type does not lend itself very well to remodeling, although there may be instances where such a formal house is desired, and where the shape of the old house is such that this tradition can be followed. Necessary additions would have to be upward.

NEW ENGLAND COLONIAL. As the original thirteen states became settled and comparatively prosperous, the people built more and more houses, using material which was available in great abundance and which was economical to work with, wood. At first these houses were patterned rather closely after the Georgian tradition. However, there were few architects, and consequently the prospective householders and their carpenters did most of the designing. This naturally led to deviations from traditional style, and it was not long before a somewhat different type had evolved, which came to be known as New England Colonial. The proportions achieved were so pleasing that the type has survived and is used to a great extent today.

The characteristics of this style are extreme simplicity and symmetry, the windows being grouped around the main entrance, which is almost invariably located in the center of the front elevation. Usually there is a window over this, with the other windows spaced at intervals on either side of the center line of the doorway. The walls are covered with narrow clapboards, and the corners are finished with vertical corner boards. The eaves are very simple, with hanging gut-

ters. Wood or fireproof shingles may be used on the roof, which is usually given a fairly steep pitch, say from $\frac{3}{8}$ to $\frac{1}{2}$.

In present-day adaptations of this type, chimneys are sometimes placed at each gable end. Double-hung windows are used, often with comparatively small panes of glass.

Fig. 6 shows the original old Payne homestead, whose design follows the New England Colonial tradition. This style was often referred to as the "Salt Box."



Fig. 6. Old Payne Homestead

Fig. 7 shows a present-day New England Colonial house which deviates from tradition to the extent of a porch, lower roof levels, and dormers. From the floor plans, also shown in Fig. 7, you will note that the rather severe room arrangement explained for the Georgian type is required here also.

From the standpoint of remodeling, this type lends itself very well, especially in adding a second story to a one-story house, or in modernization of the interior. The bungalows built some years ago, as well as many rectangular-shaped old houses, can be remodeled at relatively small cost to resemble the house shown in Fig. 7.

GARRISON COLONIAL TYPE. During early Colonial days, when Indians still were to be feared, a special Colonial house was developed in which the second story extended out beyond the first story, to make it easier to fight off an attack. This type is known as the Garri-

son Colonial and is illustrated in Fig. 8. You will notice that it is very similar to the New England Colonial, the main difference being the overhanging second story.

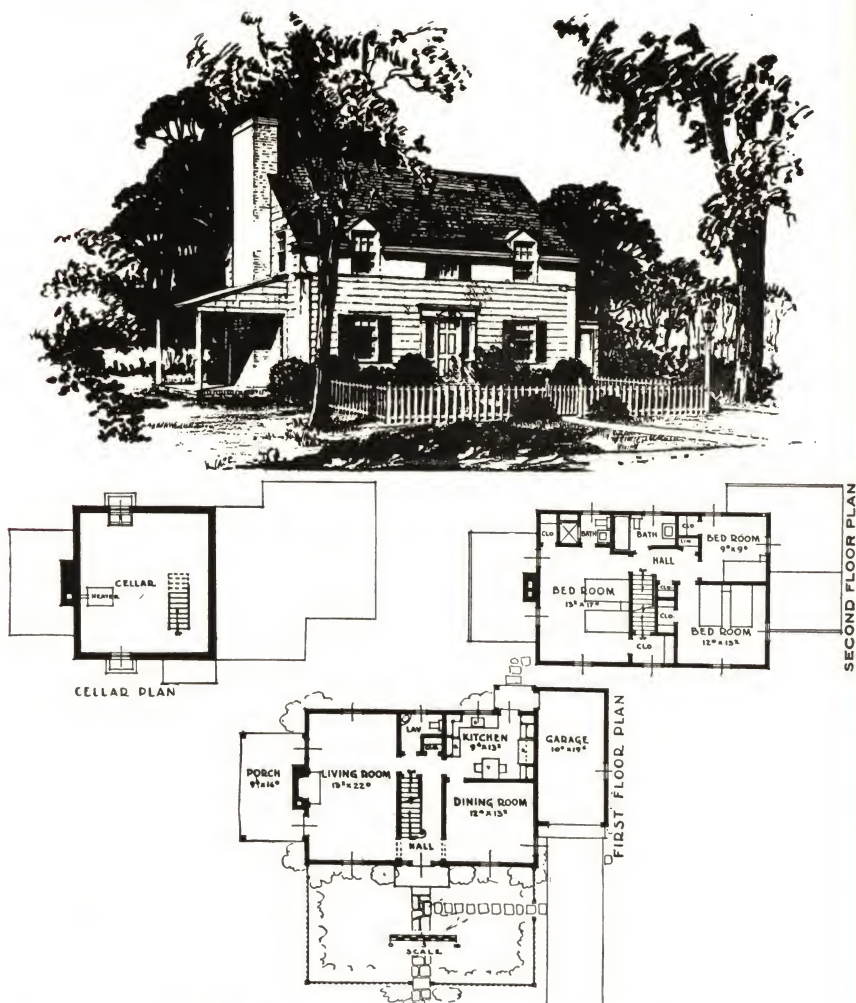


Fig. 7. New England Colonial with Present-Day Deviations
 Courtesy of Johns-Manville, New York City

Old frame houses can sometimes be remodeled to conform to this style by adding wings and adding or enlarging second-floor rooms.

CAPE COD STYLE. Some years ago a pronounced deviation from the earlier Colonial types developed in the Cape Cod region of

New England. This style was so appealing that today it is one of the most popular types, both in building and in remodeling. Fig. 9, a



Fig. 8. Garrison Colonial House

typical Cape Cod house, exemplifies the intimate and informal charm of the type.

Among the principal characteristics of this popular style are the steeply-pitched roof with gable ends, with the eave line low (coming



Fig. 9. Cape Cod House

to about the level of the first-floor ceilings), and with the massive chimney designed to accommodate several flues. As a rule this type

of house has double-hung windows with shutters and with the sash divided into smaller lights. The walls are covered with clapboards or shingles, and the roof is of wood or fireproof shingles. This style is seen at its best where the broad expanse of the roof is unbroken. Even so, dormers can still be built on the rear elevation.

For a comparatively small house, dormers work out well only on the rear elevation. If a larger house is required, with two or more



Fig. 10. Cape Cod House with Dormers on Front Elevation

second-story rooms, then dormers must be used on the front elevation also, as shown in Fig. 10. These detract somewhat from the appearance. However, they lend themselves excellently to remodeling, and on the whole they are not objectionable.

Usually the main entrance is placed in the exact center of the front elevation, and the windows are arranged symmetrically on either side. Such an arrangement makes it almost imperative to adopt the typical Colonial plan, with an entrance hall (if there is one) in the center directly in line with the door. From the remodeling standpoint this is not objectionable, because many old houses have such central halls.

The dormers used on front elevations must be grouped symmetrically over the front door, which limits to some extent the possible room arrangement on the second floor.

Dormers on rear elevations are sometimes made continuous instead of individual. This has the advantage of making a new eave line at the level of the second-floor ceiling, thereby avoiding sloping ceilings. Another advantage is that windows can be located anywhere along the dormer wall. A continuous dormer is shown in Fig. 11.

Fig. 12 illustrates a house in which the charm of the Cape Cod type has been preserved; at the same time the rooms in the second story have been improved by raising the line of the eaves halfway up to the second-story ceiling level, in the front elevation, and placing the second-story windows partly in the wall and partly in dormers



Fig. 11. Continuous Dormer on Cape Cod House

above the eave line. This might be called a blending of the Cape Cod and the New England types. The ridge line and the eave line are lower than if the New England type alone were followed. The expanses of roof are brought down nearer to eye level, so that they contribute more to the appearance of the house. The low effect is further accentuated by the two extensions or wings, one of them a single story, and the other $1\frac{1}{2}$ stories, high.

The second-story rooms have sloping ceilings along the front wall, but the usable width of this story is so much increased and the bedrooms so greatly improved that this departure from the usual interpretation of the type is fully justified.

The Cape Cod type, and especially with variations like those explained in the foregoing, is particularly adaptable for remodeling

work on the more common type of square- or rectangular-shaped old houses. The large chimneys, the wings, dormers, centrally located front entrance, shingle and stone exteriors, and the frame construction are all details which easily can be included in remodeling plans without undue cost. For example, suppose an old house were rectangular in shape, two stories high, of frame construction, and with a centrally located front door and hallway on the first floor. There are many such old houses, highly adorned with "gingerbread," and



Fig. 12. Modified Cape Cod Type House

having old-style porches, poorly placed windows, steep roofs, and chimneys in the center of the house. Many have the appearance of too great height. Such a house could be remodeled to look very much like the house in Fig. 12. One or more wings could be added for a garage or for additional rooms, the roof line could be lowered, new chimneys built at the gable ends, dormers could be added, and shingles applied as sheathing.

It is surprising what an improvement you can make in the appearance of a house by understanding the types of architecture and their characteristics, and then planning the remodeling to conform to one of the types. Through this procedure, many ugly old houses have been transformed into homes of real charm.

SOUTHERN COLONIAL. At about the same time that one type

of architecture was being developed by the pilgrims in Massachusetts, other pilgrims, who had settled in Virginia, began to develop a type of domestic architecture differing somewhat from the Colonial types already discussed.

The southern climate made possible much outdoor living and also made it desirable to protect windows from the direct rays of the



Fig. 13. Southern Colonial Style House

sun. Thus the Virginia houses were built with wide verandahs whose roofs were supported by large columns extending the full height of the house.

Other details of the houses built in Virginia conformed rather closely to the Georgian type.

Fig. 13 shows a present-day house with many of the characteristics of the original Southern Colonial style. The centrally located entrance makes necessary the standard Colonial plan, with central entrance and stair halls, and the rooms on either side conforming to a symmetrical arrangement of the windows. The second-floor window over the entrance door, due to the portico roof immediately above it, will always be in shadow.

A Southern Colonial house may have a hip roof, as in Fig. 13, or it may have a low-pitched roof with gables at each end, and possibly with dormer windows.

Walls may be constructed of masonry, or they may be frame, with either shingles or clapboards as siding.

This type of architecture does not lend itself too well to remodeling, because of the expense involved. However, some very beautiful effects can be obtained by owners to whom cost is not important.

DUTCH COLONIAL. The early settlers in New York, New Jersey, and Pennsylvania adopted or evolved a type of architecture known as Dutch Colonial. Its most distinguishing characteristic is its roof, which is separated into two slopes. Such roofs are called *Mansard*,



Fig. 14. Dutch Colonial House

after their designer. Fig. 14 shows a Dutch Colonial house with Mansard roof.

This type of roof was adopted because people recognized that by its use they obtained a low appearing house of $1\frac{1}{2}$ stories, similar to the Cape Cod type but with more room on the second floor than a single pitch roof could provide. Although the lower pitch of the two-slope roof is quite steep, the upper one is almost flat, allowing a considerable extension in room space.

The Mansard roof can be used in connection with overhanging eaves, as shown in Fig. 14, or with practically no overhang. In either case a continuous dormer is used, which has the effect of establishing a second-eave line at about the level of the second-story windows. This provides bedrooms with full height ceilings, which is a distinct advantage.

Exterior walls may be half stone and half frame, as in the house shown in Fig. 14, or they may be all of brick or frame. Shingle or clapboard finish can be used on the frame walls.

The Dutch Colonial in some respects does not have as attractive an appearance as other types, but the interior benefits more than make up for any lack of exterior charm.

This is another type which lends itself particularly well to remodeling, as in single-story houses the interior space can be almost



Fig. 15. French Provincial House

doubled by the addition of the half-story dormers and a Mansard roof; or, old houses having a full two stories can be given an appearance of less height and can be improved in many other ways by following this type.

FRENCH PROVINCIAL. A type of architecture which for many years has not been used to any extent, but which is now gaining in popularity, is illustrated in Fig. 15. The Mansard roof, which is French in origin, and the round-headed dormer windows mark this type as French Provincial. In some cases houses similar to the one shown in Fig. 15 have false shutters, the front entrance flush with the wall, and roofs somewhat less steep. False window sills for the first-floor windows are sometimes used, also.

Fig. 16 shows a small French Provincial house, somewhat along Dutch Colonial lines insofar as the roof is concerned, except that the lower slope is much steeper. The house in other respects is quite different in appearance. The entrance porch and the treatment above it, the detail of the stone trim around the doorway, the stone quoins at the corners, and the round-headed dormer windows are some of the French Provincial characteristics which are entirely lacking in Dutch Colonial houses. Other details, such as the round windows



Fig. 16. French Provincial House with Mansard Type Gables

over the entrance door and in the garage doors, and the arched heads to the garage doors give character to the house.

FRENCH-CANADIAN TYPE. The people who originally settled near Quebec in Canada came from northern France. As they prospered in their new surroundings they began to build houses, and these, quite naturally, were modeled after the houses of their homeland. Deviations from pure French types occurred because there were few architects, and because conditions in Canada were so different from those in France. After a time, as more and more houses were built, a distinctive French-Canadian type was developed. This type, somewhat like the Cape Cod houses, has a pleasing character of its own.

Fig. 17 shows a house designed following the French-Canadian type, with dormer windows inserted in the steep roof to give more light and air to the second-floor rooms. You will recognize that the appearance of this house is different from that of the Cape Cod houses

in Figs. 9 and 10. The features which distinguish the French-Canadian house (shown in Fig. 17) from the other types are the outward curve at the eaves of the steeply sloping roof, and the high narrow casement windows with small lights.

Both the French Provincial and the French-Canadian type can be used to great advantage in remodeling, if the house to be remodeled can be changed over to either of these styles without too great expense. Certain materials, like those shown on the houses in Figs. 15, 16, and 17, are required to give the characteristic effect of this style, and it



Fig. 17. French-Canadian Type House

would not be economical to convert an old frame house into a house with stone walls. However, in some instances veneers of stone can be used to accomplish the desired effect without too great cost.

SPANISH TYPE. Spaniards coming to North America settled mostly in Florida and in southern California, geographic locations having almost the same climate as their native Spain. Therefore it is only natural that their houses were built in the Spanish tradition.

Fig. 18 shows the Spanish type of house now found in large numbers, especially throughout the South. The characteristic features are rather low-pitched roofs of curved red tiles, stucco or concrete walls, and decorative balconies and grilles. Sometimes the walls have patterns worked into them, especially when stucco is used.

You can achieve a house of this type quite readily and without undue expense through remodeling, especially in the case of the common two-story rectangular frame house. Stucco can be applied, the

roofs lowered, and balconies, tile, and other typical details can be added to give it the characteristic Spanish appearance.



Fig. 18. Spanish Type House

MONTEREY TYPE. This type may be considered a blending of Spanish and Southern Colonial tradition.

A characteristic feature is the use of long second-story balconies, like the one shown in Fig. 19. These balconies are usually without



Fig. 19. Monterey Type House

support from the ground but rest on brackets carried out from the walls. The windows ordinarily are of standard Colonial type, with or without shutters.

The house in Fig. 19 has a **T-shaped** floor plan, with a wide terrace extending around three sides at the ground or first-floor level. The first-floor plan is not greatly influenced by the type. It could, in fact, be treated in several ways. The second-floor plan, however, must be especially designed in relation to the balconies.

Differences of level between the various first-floor rooms are quite common, especially where the terraces are slightly above the surrounding ground level.



Fig. 20. Ultra-Modern House

If your old house is **T-shaped**, or if you have no objection to a considerable expenditure, you can follow this style in remodeling with beautiful results. Stucco may be used to advantage.

MODERN TYPE. The modernistic house has already been mentioned as a decided departure from the familiar traditional types. For example, in Fig. 1 the house is built of concrete and has plain white walls surmounted by flat roofs. Portions of the roof can serve as outdoor living areas.

Although plain white concrete walls and flat roofs distinguish this type, there is no reason why you could not create similar effects using brick and stone, or even wood.

The modern type shown in Fig. 1 differs considerably in appearance from what might be called the ultra-modern type of house. An example of the latter is shown in Fig. 20. The large second-floor balcony with its roof supported on plain posts, the wide overhanging eaves, and the extremely low-pitched roof are conspicuous traits of this type. The large corner window with horizontal division bars, which you see at the extreme left of the illustration, is even more characteristic.

A distinguishing feature which is common to this type is the use of windows that extend to, and around, corners. Another is the use of glass blocks for portions of the walls.

QUESTIONS AND ANSWERS

Figs. 21 and 22 contain a number of small sketches of houses featuring different architectural types. The questions and answers which follow relate to the houses in these two figures. Sketches 1 through 8 appear in Fig. 21 and Sketches 9 through 13 appear in Fig. 22.

We believe you will find it interesting, as well as an instructive review of this chapter, to test your ability to recognize the various styles of architecture.

1. To what type does Sketch 1 belong, and why?

Answer. English Half-Timber, because of the extensive timber work, lack of symmetry, prominent gables, and large chimney. Without the half-timber work, the house might be classed as Tudor.

2. To what type does Sketch 2 belong, and why?

Answer. Georgian, because of the symmetrical arrangement of windows and doors, and the classical detail of the entrance.

3. To what type does Sketch 3 belong, and why?

Answer. Modernistic, because of flat roofs, corner windows, box-like appearance, and omission of decorative details.

4. To what type does Sketch 4 belong, and why?

Answer. Southern Colonial, because of symmetrical arrangement, and especially because of the two-story verandah.

5. To what type does Sketch 5 belong, and why?

Answer. Dutch Colonial, because of the double-sloped main roof, with gable ends.

6. To what type does Sketch 6 belong, and why?

Answer. New England Colonial, because of the symmetrical arrangement of windows and doors, simplicity of detail, and use of clapboards.

7. To what type does Sketch 7 belong, and why?

Answer. Monterey, because of the low-pitched roofs and long second-story balcony.



(1)



(2)



(3)



(4)



(5)



(6)



(7)



(8)

Fig. 21. Various Types of House Architecture

8. To what type does Sketch 8 belong, and why?

Answer. This type of house is so seldom built that it was not described in this chapter. It is Italian, because of low-pitched roofs, plain walls, balconies and decorative chimney top.

9. What type would you call the house in Sketch 9?

Answer. This house might be considered Old English, because of the half-timber work, large chimneys, and low eaves of the wing at the right. However, the tower with a steep conical roof gives it a French flavor. Therefore you might also call it Norman French. Norman types were not included in this chapter because, except for the one characteristic of their conical tower, they are seldom used.



9



10



11



12



13

Fig. 22. Various Types of House Architecture

10. To what type does Sketch 10 belong, and why?

Answer. This is another type not included in this chapter. It is called Early English, because there is no symmetry, and because of the high-pitched roof with eaves at the first-floor ceiling level, and the detail of the front porch.

11. To what type does Sketch 11 belong, and why?

Answer. French Provincial because of the Mansard roof, dormer windows with curved heads, and the outward curve of the roof at the eaves. You will notice that first-floor windows also have the false shutters and sills which were referred to in the description of this type.

12. To what type does Sketch 12 belong, and why?

Answer. Tudor, because of prominent gables and chimney, absence of formality, and lack of symmetry. The high gables and chimney pots especially indicate this type.

13. To what type does Sketch 13 belong, and why?

Answer. Cape Cod, because it is a story-and-a-half, with eaves at first-floor ceiling level and large roof areas. The windows are of Colonial type, and the entrance is nearly at the middle of the front elevation; also there is an air of simplicity about the entire design.

In Chapter V you will find a discussion on how to select the architectural type which is best adapted to the house you propose to remodel, and to your remodeling requirements.



A SMALL HOUSE IN THE CAPE COD TRADITION, WITH HEAVY HORIZONTAL SHADOW LINES

Courtesy of Curtis Companies, Incorporated, Manufacturers of Curtis Woodwork, Clinton, Iowa

CHAPTER II

How to Read Architectural Plans

BEFORE the carpenters, masons, and other mechanics so much as turn a hand in the actual remodeling of a house, complete and definite plans must be drawn up, so that both owner and mechanic will understand clearly what is to be done, the kind and quality of materials to be used, and other pertinent facts. Hence, this chapter, defining architectural plans and their uses, and constituting a short course in how to read them, is important.

NAMES OF PLANS. When we speak of *plans* for remodeling a house, we refer to a group of drawings. These, as mentioned before, show every detail of the proposed work. The exterior appearance, location of doors and windows, division of space into rooms, design of fireplaces, layout of kitchen and bathrooms, and the sizes and kinds of material to be used throughout must be shown in a standard manner on these drawings, so that everyone who reads them will form the same mental picture of the finished structure and will understand the work to be done before the project is completed.

Such drawings are known by different names among mechanics and others engaged in the building trades.

Blueprints. This name is used more than all others. Most drawings are reproduced by the blueprinting process, so that any number of sets may be available.

Prints. This is an abbreviation of the word blueprint, used to some extent by architectural draftsmen or others engaged in making the drawings.

Working Drawings. This name, less commonly used, originated because the drawings show the work that is to be done.

Plans. People not engaged in the building industry usually refer to drawings by



this name, since to them a plan is an outline of something they expect, or plan, to do.

The drawings can be called by any of these names without causing confusion. In this book we use *blueprint* most often.

The word *plan* is used in another sense which should not be confused with its application to the blueprints as a whole. Among draw-

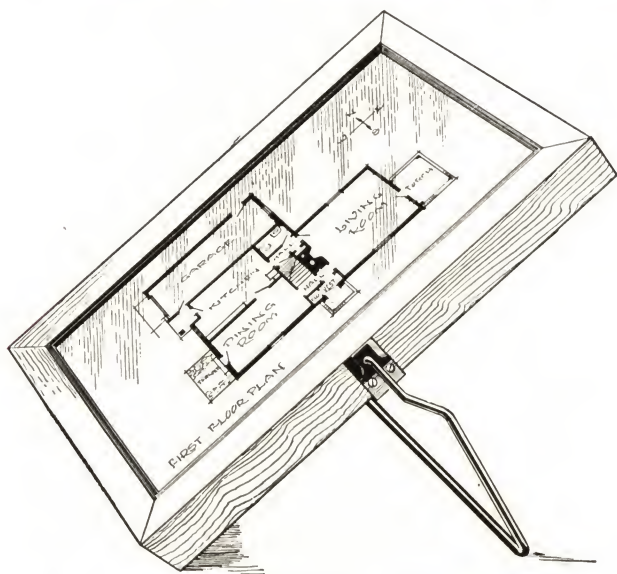


Fig. 23. Blueprint Frame Showing How Tracing Appears in Frame

ings, those showing any view of an object as seen from above are called *plan views*. The name comes from a principle of Mechanical Drawing. Thus, in architectural drawing, the drawings which show arrangements of rooms, framing, or plots of ground are referred to as floor plans, framing plans, and plot plans.

HOW BLUEPRINTS ARE MADE. Blueprints are made from pencil or inked tracings of architectural drawings. Chapter VI deals with the making of these drawings and tracings.

In average-sized cities and towns there are firms whose business is making blueprints. They produce better blueprints at less cost than you could, so it is advisable to patronize blueprint firms. If no such firms exist in your locality, however, you can produce blueprints with the equipment described here.

A blueprint frame, like that illustrated in Figs. 23 and 24, is necessary. You can buy this from any drafting or instrument supply firm.

Blueprint paper is a sensitive paper coated on one side with chemicals which react to sunlight or very strong artificial light. This paper must be kept in an absolutely dark container; otherwise, like exposed kodak film, it will be worthless.

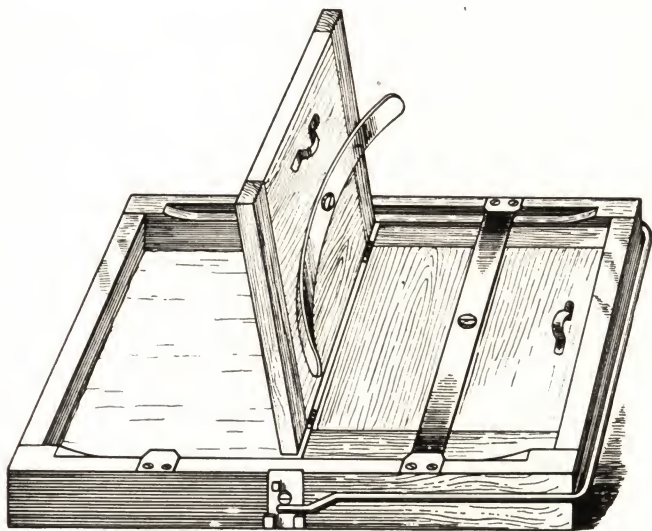


Fig. 24. Back of Blueprint Frame

In making a print, the tracing is laid face down on the glass, and the coated side of the paper is placed against it. Then the back of the frame is clamped down tightly and the frame is set with the glass exposed to artificial light or bright sunlight.

The length of time which blueprint paper should be exposed to the light depends upon the quality and freshness of the paper, the chemicals used, and the brightness of the light. Some paper is so treated that an exposure of one minute or less in bright sunlight will give a good print. Other papers need twenty minutes or more.

After exposure the blueprint paper is taken out and thoroughly washed in clear water for several minutes, then hung up to dry. If running water cannot be used, the paper must be washed through a sufficient number of changes until the water is clear. It is a good plan

to use a tank having an overflow, so that the water may remain at a depth of about 3 or 4 inches. If the paper has been prepared freshly, and the exposure is timed properly, the coated surface of the paper will now be a clear deep blue, except under the ink lines, where it will be white.

HOW BLUEPRINTS ARE USED. Bidding. When blueprints of the completed drawings have been made, the general practice is to give sets of them to two or more general contractors, for their bids on the proposed remodeling. Each contractor studies the blueprints, estimating the amounts of material and labor necessary to complete the work indicated. To his estimated costs, he adds his overhead and profit, and submits his "bid" to do the specified work for a certain amount of money. The most favorable bid, as to money involved and the contractor's reputation, usually is accepted. Contracts for the work are then made.

In this matter of securing bids, blueprints of clear and complete drawings are important. If a contractor knows exactly what is required, his bid will be lower than if poor or partial drawings are presented to him. In the latter case, he must make certain that his offer covers possible omissions from, or reinterpretations of, the plans.

Some people prefer to deal with individual carpenter, mason, plaster, and plumbing contractors, rather than with a general contractor. In such an instance, one set of blueprints must be given to each contractor who is asked to bid on the job. A great deal more supervision is required when separate contracts are made than if a general contractor is in charge of, and responsible for, the entire job. For the average owner, it is advisable to deal with a general contractor.

Construction. After the contracts have been made, sets of blueprints are used by the various mechanics as a guide to their construction work. Thus, the blueprints become the authority for every phase of the work—dimensions, room arrangements, materials, and other vital details.

Permits. In most localities, permits must be obtained from building commissions, building inspectors, or other officials before a remodeling job can be undertaken, and blueprints must be presented for inspection in order to obtain such permits. Mechanics sometimes use blueprints, also, in obtaining the individual permits which are required in some localities.

Building Loans. If remodeling work is to be financed by government or other loan, blueprints must be presented when application for the loan is made. Here, also, well-designed drawings are important. Blueprints, showing in clear and complete detail a well-planned procedure for remodeling, inspire confidence that the house will be a good mortgage investment.

WHAT BLUEPRINTS CONTAIN. In order to show all of the necessary information for remodeling, the blueprints must be made from certain standard types of drawings. These should include the following:

Floor Plans. A floor-plan drawing, as previously explained, shows room arrangements in basements, on the first and second floors, and in attics—one floor plan for each floor of the house. These plans also show the arrangement of partitions, electric outlets, bath and kitchen fixtures, fireplaces, closets, doors, windows, stairs, and like details. Further in the chapter you learn how to visualize these drawings.

Elevations. An elevation view of a house might be termed a picture of one side, showing windows, doors, roof, porches, materials, heights, and everything else which is visible from the outside. Since a house has four sides, four elevation views are necessary in a set of blueprints for the house. Elsewhere a detailed explanation is made of elevation views.

Sections. Sections are drawn (vertically, as a general rule) to illustrate structural parts which cannot be shown on plan or elevation views. For example, an elevation view shows the height, width, and exterior appearance of a roof, but cannot show how the various supporting parts are put together, their sizes, the kind of material, and like details. The function of a sectional drawing is to show specific structural information about details that are hidden. Visualization of such drawings is explained for you in following material.

Plot Plans. A plot plan, or one of its variations, a survey or location plan, shows the size, shape, and contour of the building lot, location of the utilities, and proposed position of the house on the lot.

Mechanical Plans. In a well-designed set of drawings, locations for installations of such equipment as plumbing, heating, and electrical work are frequently shown on separate drawings called *mechanical drawings* or *mechanical plans*.

Specifications. Specifications usually are typewritten on sheets of paper $8\frac{1}{2} \times 11$ inches. The work of each trade, description of materials, fixtures, and like supplementary details are explained and specified. Simple specifications can be shown directly on the various drawings.

SCALING. The plan views, elevation views, and other drawings which make up a set of blueprints usually are drawn on sheets of paper averaging about 18×24 inches. Such drawings are, of course,

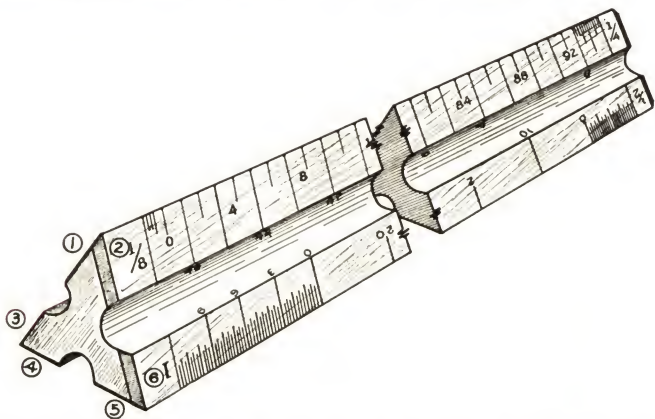
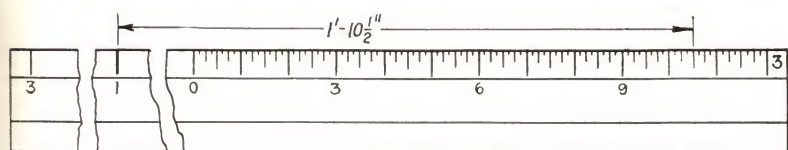


Fig. 25. Three-Sided Scale. (Encircled Numbers Indicate That There Are Six Scales on One End of Three-Sided Scale)

much smaller than the structure they represent, but their small size does not lessen their usefulness if they are drawn accurately *to scale*.

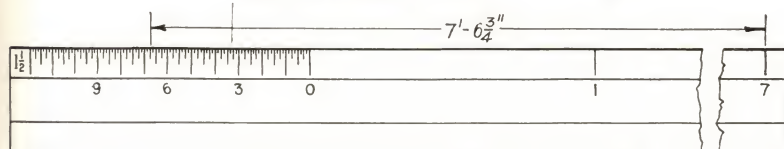
What does "*to scale*" mean? Drawing *to scale* means the substitution of some short unit of measure, such as one-fourth of an inch, for each foot. For example, we represent a dimension of 10 feet by 10 quarter inches ($2\frac{1}{2}$ inches) if we draw to the quarter-inch scale. This scale is then indicated on the drawing by the notation: $\frac{1}{4}" = 1'0"$. This means that for every fourth of an inch shown on the drawing, the actual dimension is one foot. We might also use $\frac{1}{8}" = 1'0"$, $\frac{3}{8}" = 1'0"$, $\frac{1}{2}" = 1'0"$, $1\frac{1}{2}" = 1'0"$, or $3" = 1'0"$. The principle for any of these is exactly as explained for the quarter-inch scale.

Drawing to any scale can best be accomplished by using a three-sided scale such as shown in Fig. 25. These may be purchased from drafting or stationery firms, or wherever school supplies are sold. Several of the scales on the three-sided scale are shown in Fig. 26. For



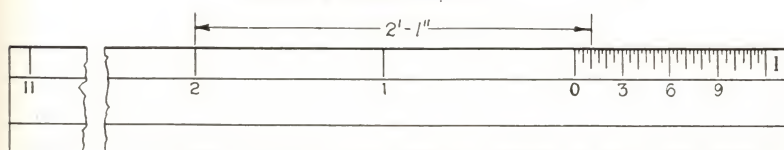
SCALE 3-INCHES = 1-FOOT

A



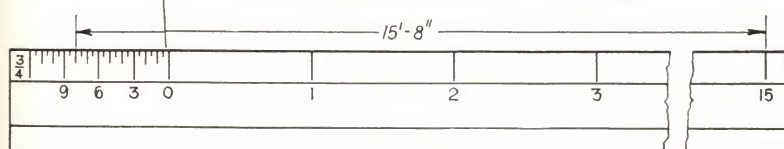
SCALE 1 1/2-INCHES = 1-FOOT

B



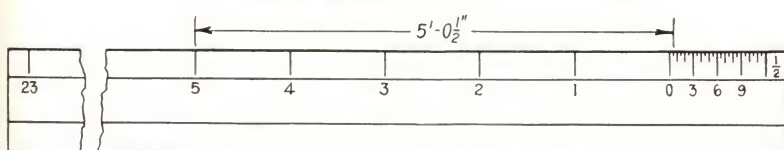
SCALE 1-INCH = 1-FOOT

C



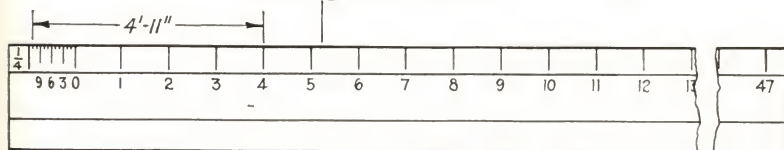
SCALE 3/4-INCH = 1-FOOT

D



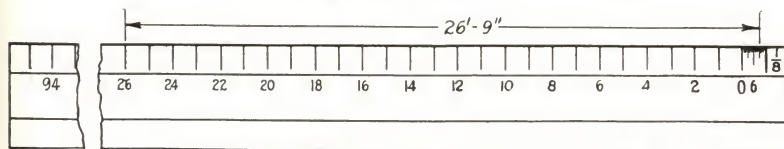
SCALE 1/2-INCH = 1-FOOT

E



SCALE 1/4-INCH = 1-FOOT

F



SCALE 1/8-INCH = 1-FOOT

G

Fig. 26. Various Scales

example, the $\frac{1}{8}"$ scale which you see in Fig. 25 is given at *G* in Fig. 26. The $\frac{1}{4}"$ scale of Fig. 25 is shown at *F* in Fig. 26.

You will note, especially in Fig. 26, that at one end of each scale one of the divisions is marked off into a number of smaller divisions; see *F* in Fig. 26, for example. At the left end of the scale, one fourth of an inch is first divided into four, then subdivided into twelve. Each of the smallest divisions represents one inch at the $\frac{1}{4}" = 1'0"$ scale.

Example. Suppose a distance is 4'11". How would you represent this in accordance with the quarter-inch scale?

Solution. Each of the 4 feet is represented by a fourth of an inch; thus 4 quarter inches are required. The 11 inches would be represented by 11 of the smallest divisions at the left of the $\frac{1}{4}"$ scale, as illustrated at *F* in Fig. 26. In like manner, 26'9" is shown at *G* on the $\frac{1}{8}"$ scale; 5'0 $\frac{1}{2}"$ at *E* on the $\frac{1}{2}"$ scale; 15'8" at *D* on the $\frac{3}{4}"$ scale; and 2'1" at *C* on the 1" scale.

The scale must be laid flat on the drawing, with the chosen scale next to the drawing paper. Use a sharp pencil to make small dots on the paper close to the edge of the scale. With practice, the process of drawing to scale is very easy.

The $\frac{1}{4}" = 1'0"$ scale is nearly always used for drawing ordinary architectural plan and elevation views. Larger scales may be used for details. The $\frac{1}{8}"$ scale is used for large drawings.

If a standard three-sided scale is not available, an ordinary 12-inch rule or mechanic's folding rule may be used. Either of these rules is divided into quarter inches and may be used to lay out distances, as explained for the $\frac{1}{4}"$ scale in Fig. 26. These rules are not marked with the small divisions used to represent inches shown at the left end of the $\frac{1}{4}"$ scale of Fig. 26. However, they can be closely approximated because each one-fourth inch is divided into eighths and sixteenths; therefore, an eighth of an inch will represent 6 inches, and a sixteenth of an inch will represent 3 inches.

The scale used should be shown on the drawing like this:

$$\text{Scale } \frac{1}{4}" = 1'0".$$

As explained elsewhere, not all distances, thicknesses, heights, and other dimensions can be shown on a drawing, but if the drawing is made accurately to scale, and the scale is indicated, the distances can be determined.

DIMENSIONS. Most important on an architectural drawing are the dimensions. By their use mechanics are able to find actual sizes, widths, lengths, heights, and all other measurements. Also, anyone reading blueprints uses the dimensions to a large extent in forming his impression or mental picture of the house which the blueprints represent. There are two equally important methods of determining dimensions.

Actual Figures. In an actual-figure dimension, the measurements are indicated by figures. For example, the symbol 3'0'' is an actual-figure dimension and means 3 feet and no inches. The single

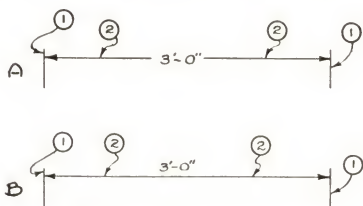


Fig. 27. Typical Dimension Symbols

mark at the right of and slightly above the 3 means *foot* or *feet*. The two marks at the right and slightly above the zero mean *inch* or *inches*. These foot (or feet) and inch (or inches) symbols are standard on all drawings.

Actual-figure dimensions are used on drawings unless their further use would cause confusion.

Fig. 27 shows two typical and complete actual-dimension symbols, either of which is correct. They are used according to the draftsman's preference. The symbol at A is the open or broken variety, so-called because the dimension line (2) is broken to allow room for the dimension figures. The symbol at B has an unbroken dimension line. In both symbols the extension lines (1) indicate the limits of the dimension.

Fig. 28 illustrates the use of extension lines. Assume that the rectangle illustrated is an ordinary living-room rug. The dimensions indicate that it is 9'0'' by 12'0''. Another way to write this size is 9'0''x12'0''. The small letter *x* means *by*. As in Fig. 27, all extension lines are numbered (1). The extension lines for the 12'0'' dimension are exactly above the A and B corners of the rug. Those for the 9'0'' dimension are directly opposite the A and D corners. In other

words, the extensions are directly in line with the outside edges of the rug, and each pair has between them the measurement indicated by the figures.

All dimensions for horizontal dimension lines should be horizontal (parallel with the dimension lines) and approximately centered between the extension lines; see the 12'0" dimension, Fig. 28. All dimensions for vertical dimension lines should be vertical (parallel

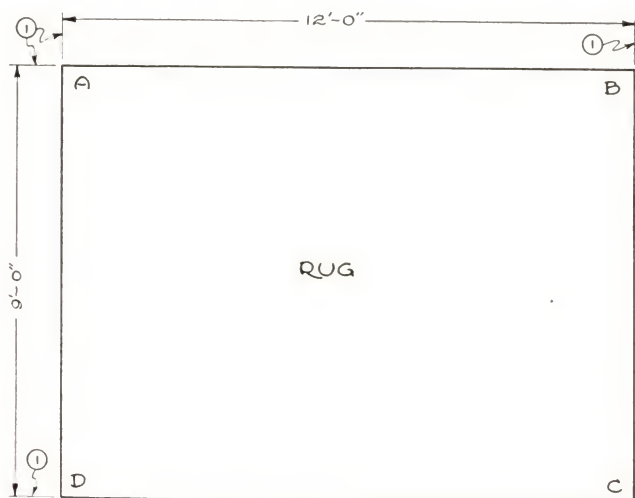


Fig. 28. Use of Extension Lines

with the dimension lines) and approximately centered, so that the figures are read from bottom to top, as shown in Fig. 28.

The dimensions for the rug in Fig. 28 illustrate the scaling principles previously explained. Set the $\frac{1}{4}"$ scale down along the side AB . If the zero on this scale (see F in Fig. 26) is put at the B corner, then the A corner will be exactly at 12 on the scale; thus the dimension line AB , in Fig. 28, is 12 quarter inches long. At the $\frac{1}{4}"$ scale, one-fourth inch represents one foot. Therefore, the side of the rug, AB , is actually 12'0" long. If a three-sided scale is not at hand, a 12-inch rule or mechanic's folding rule can be used by placing the edge of the rule along the line AB and counting the number of quarter inches.

Figures Missing. Actual-figure dimensions are not always shown on a drawing. However, if the drawing is made to the $\frac{1}{4}"$ scale, for

example, each dimension can be measured. You can "scale" the dimension by putting the $\frac{1}{4}$ " edge of the three-sided scale along the distance in question and counting the number of one-fourth inches or fractions thereof.

Assume that Fig. 29 shows another rug, the dimensions for which have not been shown and are therefore unknown. The scale indicates that the outline of the rug was drawn to the $\frac{1}{4}$ " scale.

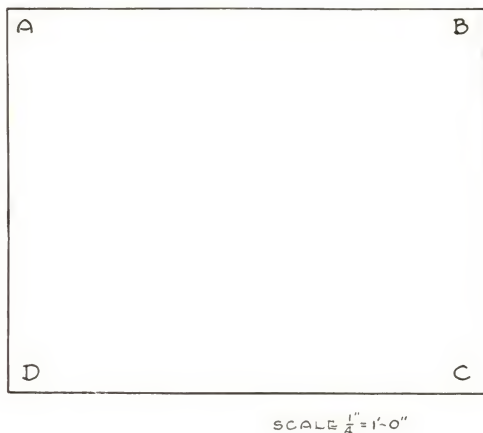


Fig. 29. Rug Having Unknown Dimensions

Along line AB , put the edge of the three-sided scale on which the $\frac{1}{4}$ " scale appears. Put the zero on the scale above either A or B . You will see that line AB is exactly 10 quarter inches long; therefore, the actual length of the rug is 10'0". Follow the same procedure for finding the length of line AD , and you will find that AD measures exactly 8 quarter inches and is therefore 8'0". Thus, the rug measures 8'0" x 10'0". Again, a common 12-inch rule or a mechanic's folding rule can be used to find the same dimensions by putting the edge of the rule along lines AB and AD and counting the quarter inches.

ABBREVIATIONS. Many abbreviations are used on drawings, in specifications, and in lumber lists. Their purpose, of course, is to omit as much printing on the drawings as possible and to reduce the lettering or writing time. The principle is the same as when we write *Ill.* for *Illinois*. In the following list you will find examples of these abbreviations, with their meanings:

A.C.	alternating current	D.R.	dining room
al.	aluminum	dr.	door
approx.	approximately	drgs.	drawings
asb.	asbestos	D.S.	downspout
bal.	baluster	ea.	each
bldg.	building	el.	elevation
B.M.	board measure	ent.	entrance
bot.	bottom	ext.	exterior
B.R.	bedroom	F.B.	firebrick
br.	brass	fl.	floor
brkt.	bracket	fl.	flush
B.t.u.	British thermal unit	frm.	frame
C.A.	cold air	fur.	furring
cas.	casing	G.	gas pipe
C.B.	cornerbead	galv.	galvanized
cem.	cement	gar.	garage
ch.	chair	G.I.	galvanized iron
ch. r.	chair rail	gl.	glass
C.I.	cast iron	G.R.	gas range
ck.	check	H.	hall
clg.	ceiling	H.A.	hot air
clos.	closet	ht.	height
clr.	clear	H.W.	hot water
C.M.	center matched	inc.	include
C.M.C.	crown mold cap	int.	interior
C.M.C.	crown mold casing	jb.	jamb
C.O.	cased opening	J.S.	joist space
C.O.	cleanout	K.	kitchen
col.	column	K.C.	kitchen cabinet
col. b.	collar beam	K.D.	knocked down
comb.	combination	K.P.	knotty pine
conc.	concrete	L	angle
cop.	copper	lav.	lavatory
corn.	cornice	lb.	pound
C.S.	cast stone	L.F.	lineal feet
C. to C.	center to center	lin.	lineal
cu. ft.	cubic feet	linol.	linoleum
C.W.	cold water	lngs.	linings
D.&M.	dressed and matched	Ⓛ P. S.	light, pull switch
D.C.	direct current	L.R.	living room
d.e.	drip cap	lt.	light
d.e. wd.	drip cap window	M.	thousand
det.	detail	max.	maximum
D.H.	double hung	M.C.	medicine cabinet
diam.	diameter	mix.	mixture
dim.	dimension	mldg.	molding
div.	divided	mor.	mortar
dn.	down	mull.	mullion
do.	ditto	nos.	nosing

no.....	number	staty.....	stationary
#.....	number	T.....	tread
O.C.....	on center	T. & G.....	tongued and grooved
1-S.....	one side	T.C.....	terra cotta
opgs.....	openings	th.....	threshold
O.S.....	outside	trip.....	triple
O.S. cas.....	outside casing	2-M.....	two-member
pan.....	panel	2-S.....	two-sided
pic.....	picture	unex.....	unexcavated
pl.....	plaster	v.....	volt
pl.....	plate	V.L.....	ventilating line
P.M.....	picture molding	vol.....	volume
pr.....	pair	W.....	wide
R.....	range	w.....	watts
R.....	riser	W.A.....	warm air
r.....	radius	W.C.....	water closet
ref.....	refrigerator	W.C.....	wood casing
rm.....	room	wd.....	window
sec.....	section	wd.....	wood
sh.....	sash	w.-gl.....	wire glass
shelv.....	shelving	W.I.....	wrought iron
S.P.....	soil pipe	wp.....	waterproofing
specs.....	specifications	yd.....	yard
sq. ft.....	square feet	Y.P.....	yellow pine

VISUALIZING FLOOR PLANS

When you look at the floor plans for a proposed remodeling job, you should be able to form a mental picture of the work to be done and the appearance and arrangement of the rooms after the remodeling is completed. This visualizing process requires a knowledge of several important principles, as well as familiarity with the special language and symbols used in the building trades.

As previously pointed out, the drawings have to be made much smaller than the portions of the house they represent. This does not affect their usefulness, however, because they are drawn accurately to scale and contain all the necessary measurements. For instance, when dresses or suits of clothes are advertised in the newspaper, with illustrations much smaller than the clothes they represent, we are able to visualize the garments as they appear in actual size. The same holds true for floor plans.

Because floor plans are proportionately so small, it is not possible to draw all details exactly as they will appear in full size. For example, walls contain many parts, and it would be impossible to draw them

all on such a small scale. Therefore, we use *symbols*, each having a definite meaning either as to structure, or material, or both.

The following will explain the process of visualizing floor plans and the meanings of the various symbols used in these plans.

Fig. 30 shows a picture of a typical small house. The picture gives some idea of the exterior appearance but very little information



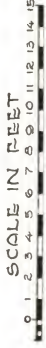
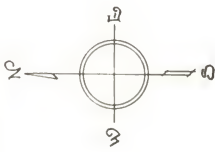
Fig. 30. Typical Small House

about room arrangement, dimensions, windows, doors, kinds of material, etc.

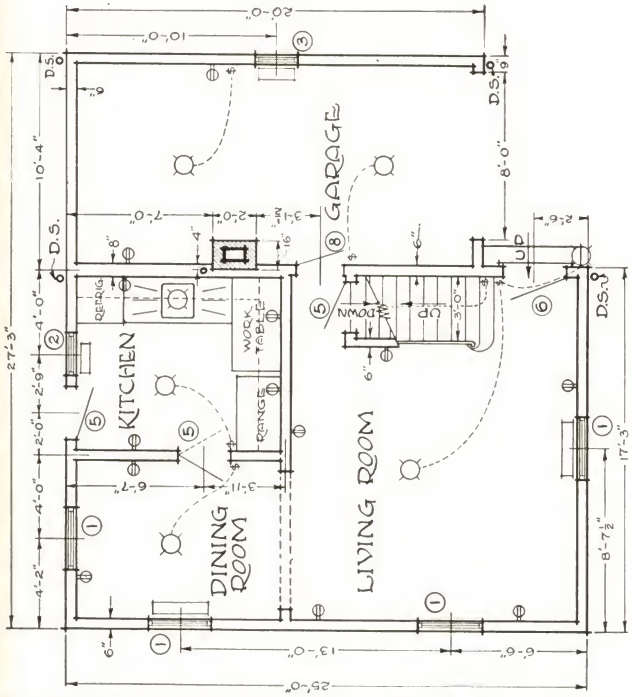
Fig. 31 illustrates the first-floor plan for the house shown in Fig. 30. This is a typical floor-plan drawing, showing dimensions, wall thicknesses, room arrangement, stairs, windows, doors, chimney, kitchen equipment, material and structural symbols, and lighting and other symbols. The drawing is complete and contains all the information necessary to visualize the entire first floor of the house. It gives structural information and shows how the rooms will appear when completed.

NOTES

LIVING ROOM AND DINING ROOM FLOORS ARE TO BE OAK. KITCHEN FLOOR TO BE MAPLE - SUEDEGUM COVERED - OWNER TO SELECT.
GARAGE FLOOR TO BE CONCRETE.
SECOND FLOOR: ALL FLOORS, EXCEPT BATHROOM, ARE TO BE OAK. BATHROOM FLOOR TO BE TILE - WALLS TO BE TILE 6'-0" UP, OWNER TO SELECT.



RESIDENCE
for
ARCHITECT
DATE



FIRST FLOOR PLAN

Fig. 31. First-Floor Plan for House Shown in Fig. 30

To understand more clearly what a floor plan is, study Fig. 32 in connection with Fig. 30. Note the line A in Fig. 30. This line cuts through the lower half of the first-floor windows.

Imagine that this house is already built and that we could use a giant saw or knife and cut right through the house on the line at A.

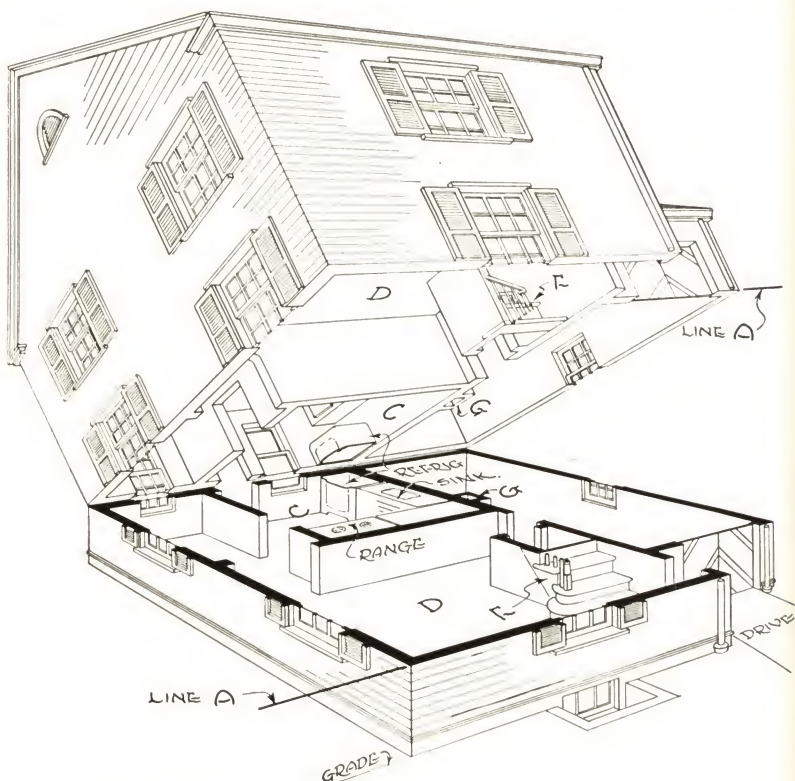


Fig. 32. House of Fig. 30, Cut to Illustrate First-Floor Plan

Imagine further that after the sawing or cutting, we could swing the part above the line A upward and leave the part below the line A in its original position. We should then have the two parts of the house in the positions shown in Fig. 32. The view of the lower part of the house in this figure is, in effect, a floor plan and can be compared with Fig. 31. Thus, a floor plan is what we should see if we sawed the top part of a house a few feet above one of the floors, moved the top away, and looked directly down on the remaining part.

In Fig. 32 the letter *D*, in the bottom part of the house, shows the lower half of the living room. The letter *D*, in the upper part, shows the top half of the living room. The letter *C*, in the bottom part, shows the lower half of the kitchen, whereas the same letter in the upper part of the house shows the top half of the kitchen. Letters *F* and *G* show the lower and top halves of stairs and chimney. Other details shown in Fig. 31 are also easily identified in Fig. 32.

With a little study and careful thought, you can master the visualization of floor plans.

The basement and second-floor plans could have been shown in the same manner as the first-floor plan in Fig. 32. To show the basement plan we should saw through the house along the line *B* in Fig. 30 and move the top part away. To show the second-floor plan we should saw through the house on the line marked *C* in Fig. 30.

In visualizing floor plans, we must remember that the plans are drawn as though we were looking directly down into the rooms, as indicated in Fig. 32. Then, once we understand the symbols, we can easily form a mental picture of each room.

SYMBOLS USED ON PLAN VIEWS. In our everyday life we use symbols constantly and have learned to recognize them. For example, the symbol \$ is known and understood by everyone.

Symbols used in architectural drawings have definite meanings which should be memorized so that the symbols can be recognized and understood at any time, on any drawing. The more commonly used symbols are explained and illustrated in the following pages.

Walls. Walls can be divided into three main classifications, namely: foundations, exterior walls, and partitions. The foundation forms the walls of the basement and supports the outside walls of the house. An exterior wall, as the name implies, is an outside wall of a house, as shown in Fig. 30. Partitions are the interior walls which divide each floor into rooms and closets.

The symbol for any type of wall is two parallel lines; the width of the space between them indicates (to scale) the thickness of the wall. If a wall is 12" thick, the parallel lines are drawn, in accordance with whatever scale is being used, to represent 12".

Fig. 33 shows typical wall and material symbols. The parallel lines are drawn first, and the material symbols are put in afterward.

A frame wall has two common symbols. One is simply the paral-

lel lines; the other is the two parallel lines, plus light wavy lines. Frame walls or partitions are built of wood parts, as illustrated in succeeding pages.

Concrete walls are used mainly for foundations, although in some modern homes the outside walls of the house are also made of concrete.

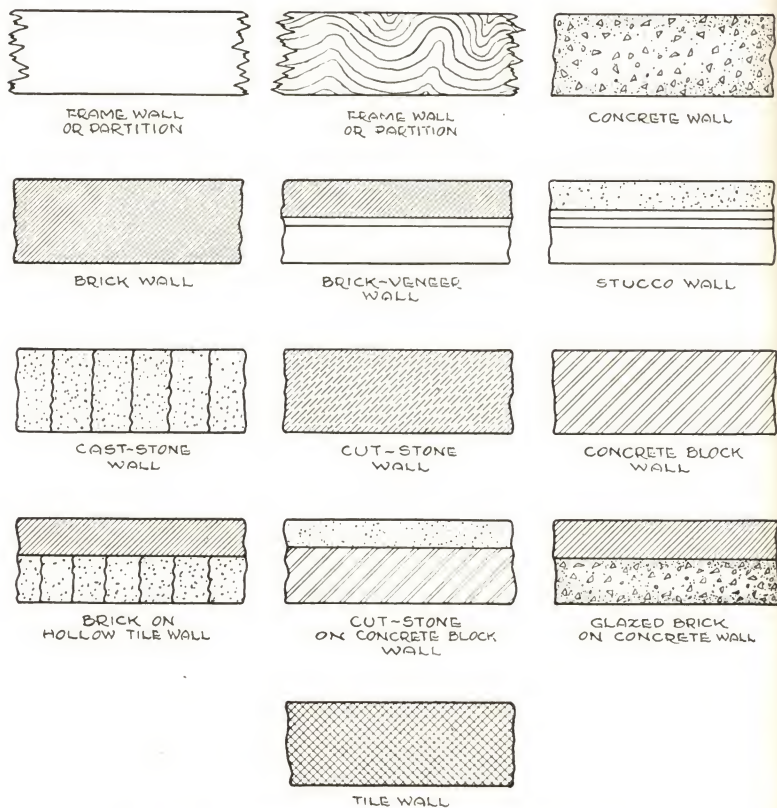


Fig. 33. Typical Wall and Material Symbols for Plan Views

Brick, brick veneer, and stucco are often used as outside walls of a house. Brick walls are of solid brick. Brick veneer walls are half brick and half frame. Stucco walls are mostly frame. These walls are explained in subsequent pages.

Brick and hollow tile can be combined for exterior walls. Such a wall, as shown in Fig. 33, has half or more of its thickness made of

hollow tile. The tile is on the inside face of the wall, and the brick forms the exterior facing or veneer.

Many exterior walls are made entirely of concrete blocks. Foundations are also made of these blocks, with mortar or asphalt serving as a waterproofing agent. Concrete block walls are sometimes faced with cut stone as an exterior veneer.

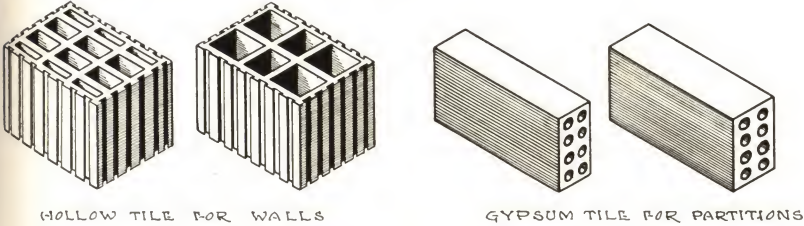


Fig. 34. Hollow and Gypsum Tile Blocks

Cast stone and cut stone may be used either in foundation or outside walls.

Interior partitions in most houses are of frame although, if the first floor is made of concrete, several forms of tile may be used. Fig. 34 shows an example of hollow tile used for walls, and gypsum tile which is often used in partitions. These masonry materials are not well adapted to frame construction, because wood shrinks and changes dimensions, and this causes masonry walls to crack and even fail.

In Fig. 31 the outside walls and inside partitions show the plain parallel lines symbol, so we know frame walls are to be constructed.

Footings. Foundations, which are generally made of concrete, require footings in most cases to keep them from sinking into the



Fig. 35. Footing Symbol

ground under the heavy loads which they support. The principle upon which footings are based is that the wider a load-bearing area, the less downward push there is per square foot. Some soils, such as gravel and hard clay, are so dense that not much settlement is likely to occur. Other soils less hard and dense would allow settlement.

The dash lines in Fig. 35, enclosing 24" of load-bearing area, are symbols for footings. They are generally twice as wide as the foundation, which is 12" in this illustration. Footings are shown in succeeding pages in connection with sectional views of walls.

Windows. In Fig. 30 we saw that the line *A*, which divided the house, cut through the windows. Thus, windows have a place on the

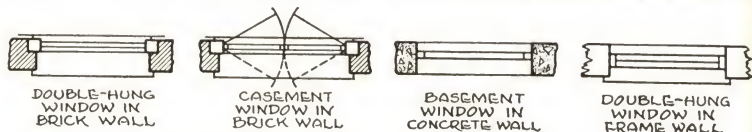


Fig. 36. Typical Window Symbols for Plan Views

floor plans. Fig. 36 illustrates the symbols for several common types of windows. These are drawn within the parallel lines which indicate walls. Note that in Fig. 31 the window symbols show double-hung windows. The sizes of windows may be given in two ways, either on the elevation views, or by a window schedule. When a schedule is used, numbers within circles are placed near each window, as shown in Fig. 31, and corresponding numbers, together with sizes, appear in the schedule. For example, the windows numbered (1) are shown as 3'0" x 4'6" in the schedule in Fig. 46. The sizes given are the over-all glass sizes in all cases.

In selecting windows for a remodeling job, remember that wood-working mills put out windows in various standard sizes. You should choose one of these because dealers will have them in stock. A window not of standard size requires special drawings and costs much more.

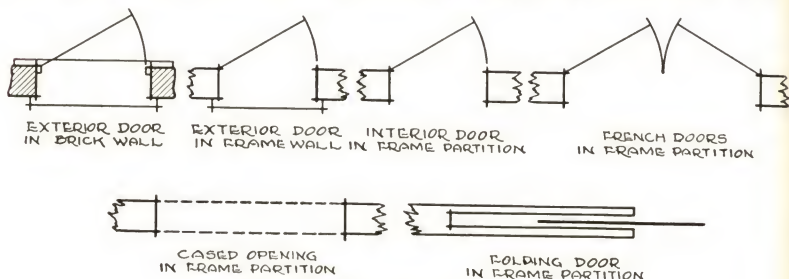


Fig. 37. Typical Door Symbols for Plan Views

Doors. Doors, like windows, are indicated by symbols on plan views. The symbols are simple, and those shown in Fig. 37 are the common types.

The slanting line indicates the direction in which the door is to swing. The sizes of doors can be given exactly as explained for windows. For example, in Fig. 31 the door leading from the dining room to the kitchen is $2'6'' \times 6'8''$, as shown in the schedule in Fig. 46. The first dimension given is the width, the second the height. Since door symbols are always drawn to scale, the width of the door can also be found by scaling, as explained under the heading *Dimensions*.

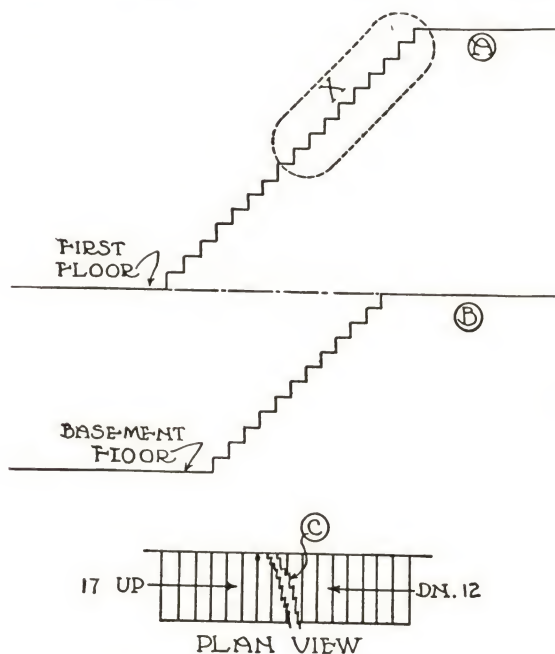


Fig. 38. Stair Symbol

Stairs. Like all other items on a floor plan, stairs are shown by a symbol which illustrates them as though we were looking down at them from some point above. The lower portion of the house in Fig. 32 shows part of a stairs.

A typical stairs symbol appears at the bottom of Fig. 38. In this particular figure, the vertical lines represent treads, or the part of the stairs we step on. Risers are the upright parts of stairs which separate the treads. The *17 up* means there are 17 risers in the stairs leading up from this floor to the next. There is another flight of stairs under the one going up. This leads down from this floor and has 12 risers,

as indicated by the *Dn. 12*. *A* and *B*, in Fig. 38, show these two stairs, one over the other; one goes to the second floor, the other to the basement. Stairs are laid out in this manner to conserve space.

To represent these two stairs in one plan view, a part of each must be shown. If we imagine that the stairs marked *X* are cut out

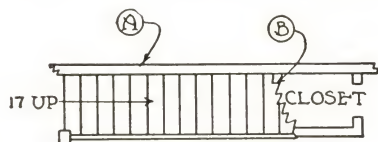


Fig. 39. Plan View of Stairway with Closet

and removed, then we can look down from above the stairs at *A* and see the lower part of these stairs and the upper part of the stairs at *B*. The zigzag lines at *C* are a standard symbol and indicate that we are looking at a part of the stairs to the second floor and at a part of the stairs to the basement.

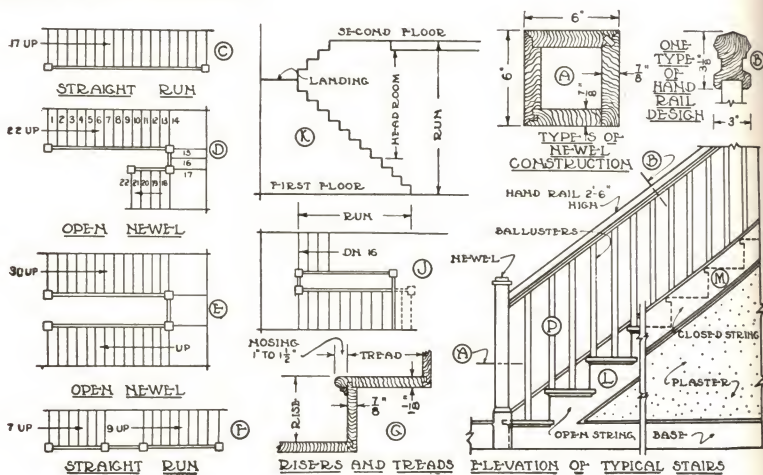


Fig. 40. Stairway Symbols

The width and total length of the stairs and the width of the treads must be drawn carefully to scale.

If a stairway has no other stairs underneath it, there is room for a closet or storage space, as indicated in Fig. 39. This occurs under basement stairs, or under stairs to a second floor where there are no basement stairs underneath.

In Fig. 40, at *C*, *D*, *E*, *F*, and *J*, other floor-plan symbols for stairs are shown. The names indicate the type of stairway. For an example of the use of these symbols, refer to Fig. 31. Here the same symbol is used as shown in Fig. 38, in that the stairs are straight run and contain the zigzag lines showing that there are two stairs, one to the second floor and one to the basement.

Fireplaces and Chimneys. Before referring to the symbols used for fireplaces or chimneys on floor plans, we must imagine that the fireplace or chimney is cut through along a horizontal line and the top part moved away so we can see the cut surface of the bottom part.

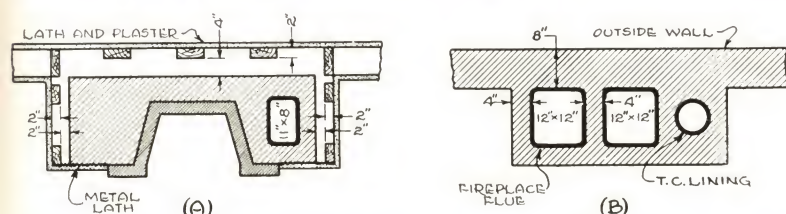


Fig. 41. Fireplace and Chimney Symbols. At (A) Fireplace in Frame Partition; at (B) Flue Arrangement in Outside Brick Wall

Note the cut surface of the chimney in Fig. 32 at *G*. Here we see a square chimney with the flue in the center. A similarly cut surface of a fireplace would look like *A* in Fig. 41. Here an 11"x8" flue is shown. The flue is for the furnace in the basement. The flue for the fireplace starts above the fireplace. Thus, where a fireplace and a furnace use the same chimney, two flues must be provided. At *B* in Fig. 41, such a chimney is illustrated. The small round flue is for some gas-burning mechanism such as a water heater.

The heavy black lines around the flues are the symbols for tile lining. The brick symbol indicates brick construction. In *A* the dots represent plaster, and the small rectangles with the wavy line symbols are the wood uprights to which the lathing is nailed. The brick symbol with the lines very close together means that the fireplace is to be lined with firebrick.

Plumbing Symbols. As a general practice, plumbing systems are not shown on the blueprints for the average small house. Therefore, the master plumber must design the system. However, in designing a house you should at least provide 8" partitions wherever large plumbing pipes (soil stacks) are to run up through them, because if parti-

PLUMBING SYMBOLS		
ITEMS	PLAN	LINE
SOIL AND WASTE	○	_____
VENT PIPE	○	_____
TILE PIPE	⊙	_____
COLD WATER	○	_____
HOT WATER	○	_____
HOT-WATER RETURN	○	_____
GAS PIPE	⊗	_____
FLOOR DRAIN	⊠	_____
SHOWER DRAIN	⊠	_____
CLEAN OUT	—	_____

Fig. 42. Plan View Pipe Symbols

tions of ordinary size were provided the hubs (joints) on the commonly used 4" C.I. soil pipes would protrude beyond the plaster. Try, also, to have the bathroom next to or directly above the kitchen, so that one soil stack may be used for both the bathroom and the kitchen fixtures. This will make for considerable economy.

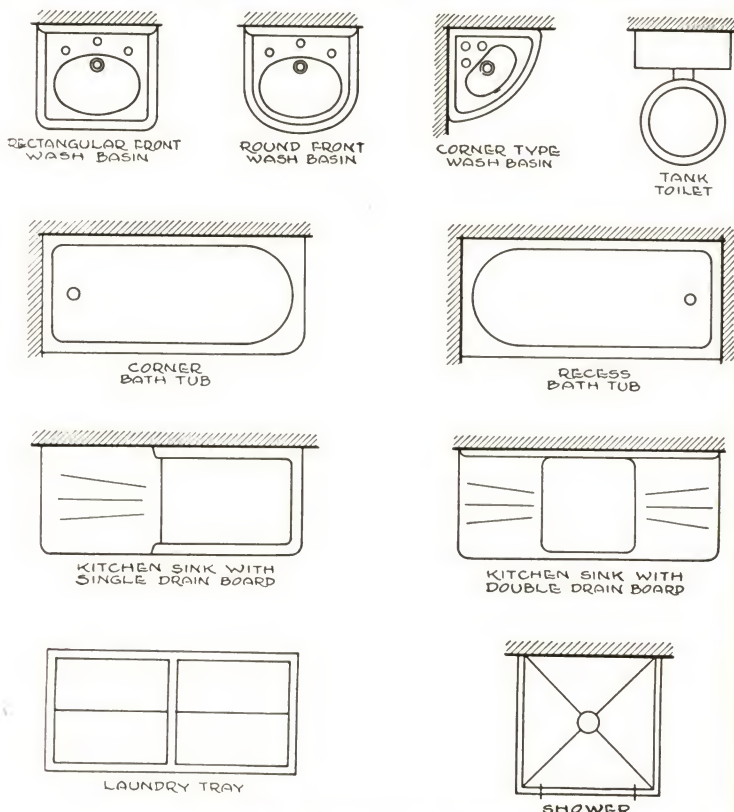


Fig. 43. Plumbing Fixture Symbols

Fig. 42 shows the symbols used to represent pipes on plan views and in partitions. The various line symbols show the location of pipes in horizontal positions (horizontal runs), while the circular or square symbols indicate pipes in a vertical position in partitions, or on the floor, such as a floor drain. Although the ordinary set of blueprints does not show all of these symbols, it is well for you to be able to recognize them.

In Fig. 31 a soil pipe, or stack, symbol is shown in the 8" partition between the kitchen and the garage.

Fig. 43 shows the symbols for all common plumbing fixtures. These are self-explanatory. All such fixture symbols are drawn accu-

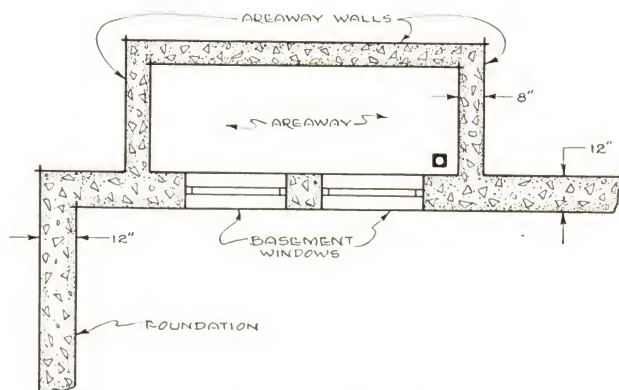


Fig. 44. Areaway Symbol

rately to scale, so that the space they require, and the space around them, may be judged accurately.

Areaways. In many instances the first-floor level of a house is only a short distance above the grade or ground level. This makes it necessary to use very small basement windows, with the result that basement areas do not receive enough light and air. To overcome this difficulty, additional earth is excavated around basement windows, making it possible to use longer windows and double-hung sash. In order to keep the earth from caving in around these windows, concrete retaining walls are constructed, as shown by the symbol in Fig. 44.

These retaining walls are known as areaway walls, and the open space beyond the windows is called the areaway. Areaway walls are usually not so thick as those of the foundation.

The bottoms of areaways have either concrete floors or gravel fills. When concrete is used, the floor is made to slope to one corner where a drain is located, as specified in Fig. 44. If gravel is used, the excavation is made 12" to 18" deeper, and this added depth is filled with gravel.

Medicine Cabinets. The symbols in Fig. 45 are used to indicate a medicine cabinet. Added to the symbol there should be a printed

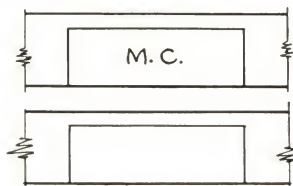


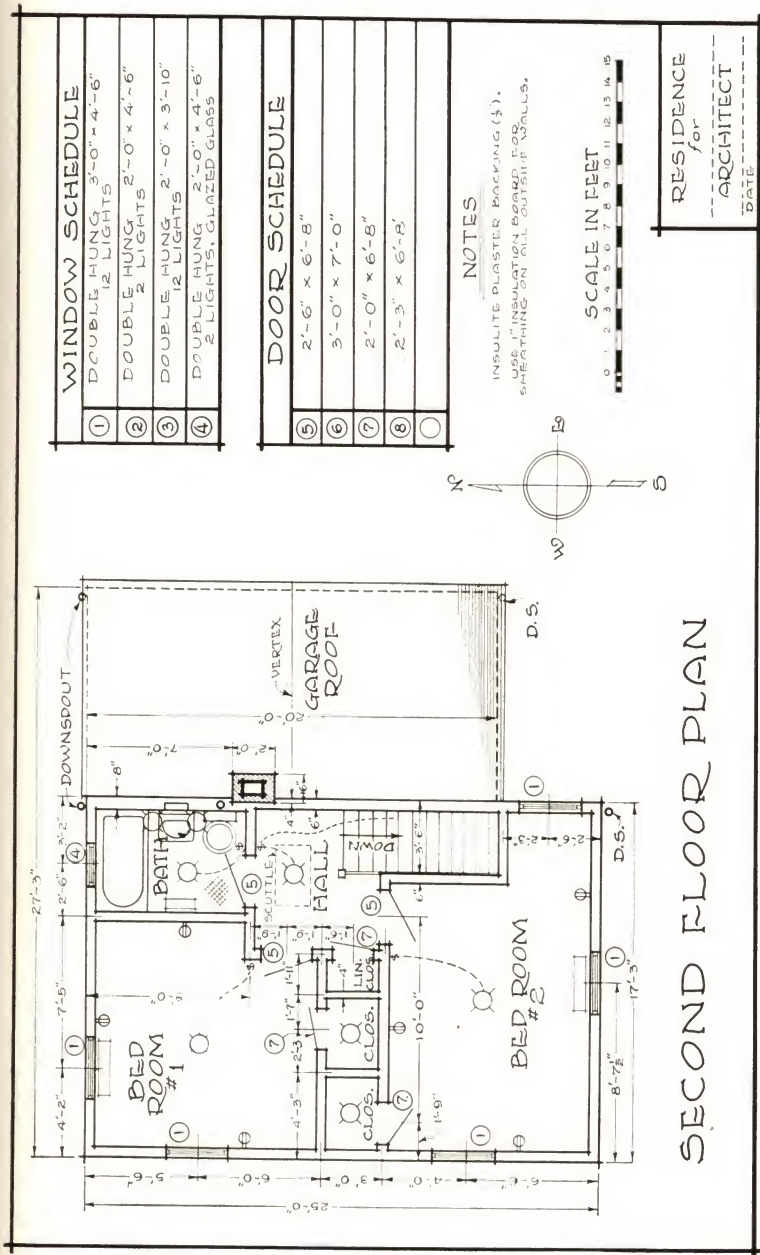
Fig. 45. Medicine Cabinet Symbols

specification giving the style and the manufacturer's name; or this information can be given in the written specifications. Note the symbol in the bathroom in Fig. 46.

Floors. There are no symbols for the various wood or concrete floors. For example, in Fig. 31 there is no symbol given in the plan to indicate the kind of flooring to be used. This information is either printed on the same sheet as the drawing or explained in written specifications. Printed specifications on Fig. 31 give this information.

Where tile floors are required, the symbol is used as shown in Fig. 46. In this second-floor plan the symbol for tile is shown on the bathroom floor.

Insulation. Standard symbols for all kinds of insulation have not been devised as yet, probably due to the fact that only in recent years has this material been developed to the point where it is used to a great extent. Three general types of insulation, however, have symbols which are becoming standard. The three symbols shown in Fig. 47 represent loose fill, board or quilt, and aluminum types of insulation. The loose fill includes wool and other insulating materials which can be poured, packed, or blown into place. The board or quilt type includes insulations which are made into various-sized rigid boards, or quilted in several thicknesses between sheets of heavy kraft paper. The aluminum type includes all reflective insulations made of thin sheets of aluminum or other metals.





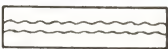
INSULATION SYMBOLS		
		
LOOSE FILL	BOARD OR QUILTS	ALUMINUM

Fig. 47. Insulation Symbols

In many cases it is difficult to draw these symbols in the small space available on a set of plans. Thus, it is wise to print specifications directly on the drawings and to include descriptions of the insulation in the written specifications. The exact type, thickness, and quality should be given, together with the specific areas which are to be insulated.



















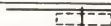
HEATING AND VENTILATING SYMBOLS	
ITEMS	SYMBOL
STEAM LINE	
RETURN LINES	
DRIPS	
HOT-WATER SUPPLY LINES	
BLOW OFF	
COLUMN RADIATOR	 PLAN
" "	 R. ELEV.
WALL RADIATOR	 PLAN
STEAM OR WATER RISER	
RETURN RISER	
RADIATOR CONNECTION	
WARM AIR	W.A.
COLD AIR	C.A.
1ST FLOOR WARM-AIR DUCT	
2ND " " " "	
1ST FLOOR COLD-AIR DUCT	
2ND " " " "	
COLD-AIR RUNS	
WARM-AIR RUNS	
VANES	
BUTTERFLY DAMPER	

Fig. 48. Heating and Air-Conditioning Symbols

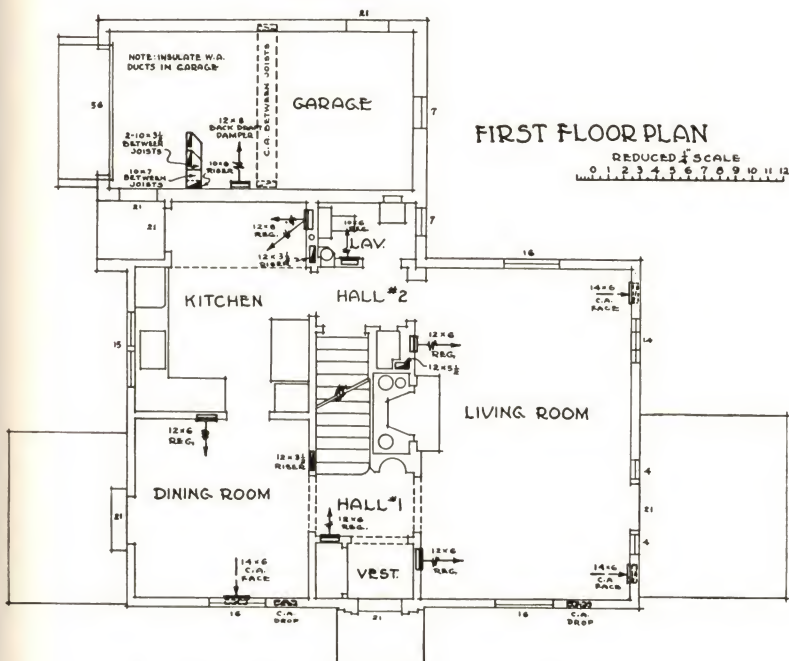
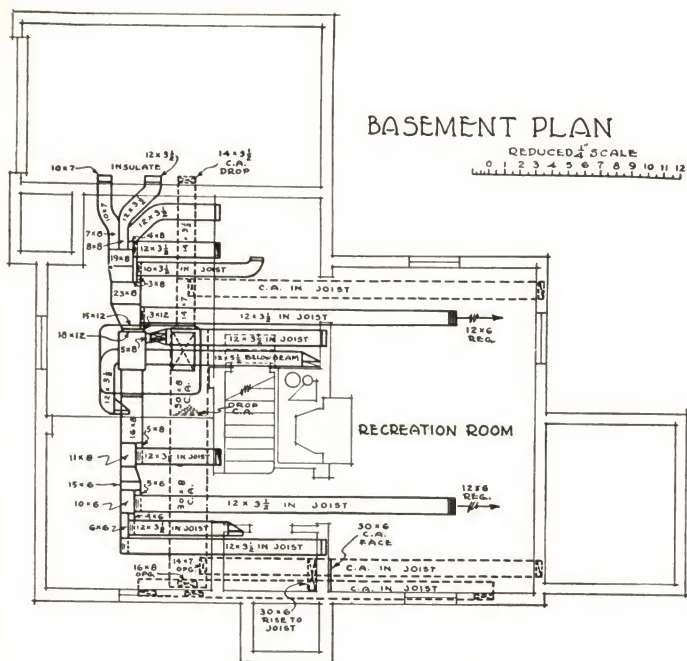


Fig. 49. Warm Air and Air-Conditioning Symbols in Typical Plans

CEILING WALL		GENERAL OUTLETS	
○	—○	Outlet.	
⊖	—⊖	Capped Outlet.	
Ⓓ		Drop Cord.	
ⓔ	—ⓔ	Electrical Outlet—for use only when circle used alone might be confused with columns, plumbing symbols, etc.	
Ⓕ	—Ⓕ	Fan Outlet.	
ⓙ	—ⓙ	Junction Box.	
Ⓛ	—Ⓛ	Lamp Holder.	
Ⓟ _{PS}	—Ⓟ _{PS}	Lamp Holder with Pull Switch.	
Ⓢ	—Ⓢ	Pull Switch.	
Ⓥ	—Ⓥ	Outlet for Vapor Discharge Lamp.	
ⓧ	—ⓧ	Exit Light Outlet.	
Ⓒ	—Ⓒ	Clock Outlet (Lighting Voltage).	
		CONVENIENCE OUTLETS	
⊕		Duplex Convenience Outlet.	
⊕ _{1,3}		Outlet other than Duplex. 1=Single, 3=Triplex, etc.	
⊕ _{WP}		Weatherproof Convenience Outlet.	
⊕ _R		Range Outlet.	
⊕ _f		Switch and Convenience Outlet.	
⊕ _R		Radio and Convenience Outlet.	
⦿		Special Purpose Outlet (see Spec.)	
◎		Floor Outlet.	
		SWITCH OUTLETS	
\$		Single Pole Switch.	
\$ ₂		Double Pole Switch.	
\$ ₃		Three Way Switch.	
\$ ₄		Four Way Switch.	
\$ _D		Automatic Door Switch.	
\$ _E		Electroliner Switch.	
\$ _K		Key Operated Switch.	
\$ _P		Switch and Pilot Lamp.	
\$ _{CB}		Circuit Breaker.	
\$ _{WCB}		Weatherproof Circuit Breaker.	
\$ _{MC}		Momentary Contact Switch.	
\$ _{RC}		Remote Control Switch.	
\$ _{WP}		Weatherproof Switch.	
		SPECIAL OUTLETS	
○ _{a,b,c-etc.}		Any Standard Symbol with the addition of a lower case subscript letter may designate a special variation of standard equipment. They must be listed in the Key of Symbols on each drawing.	
⊕ _{a,b,c-etc.}			
\$ _{a,b,c-etc.}			
		PANELS AND CIRCUITS	
■		Lighting Panel.	
▨		Power Panel.	
---		Branch Circuit—Ceiling or Wall.	
- - -		Branch Circuit—Floor, 2-wire.	
//		Branch Circuit—Floor, 3-wire.	
///		Branch Circuit—Floor, 4-wire, Etc.	
—		Feeders, Heavy lines, numbered as listed in the Schedule.	
—□—		Underfloor Duct & Junction Box—Triple System. Note: For double or single systems eliminate one or two lines. This symbol is equally adaptable to auxiliary system layouts.	
		MISCELLANEOUS	
Ⓖ		Generator.	
Ⓜ		Motor.	
ⓘ		Instrument.	
Ⓣ		Transformer.	
Ⓚ		Controller.	
ⓐ		Isolating Switch.	
		AUXILIARY SYSTEMS	
◻		Push Button.	
◻		Buzzer.	
◻		Bell.	
◇		Annunciator.	
◻		Telephone.	
◻		Telephone Switchboard.	
◻		Clock (Low Voltage).	
◻		Electric Door Opener.	
◻		Fire Alarm Bell.	
◻		Fire Alarm Station.	
◻		City Fire Alarm Station.	
◻		Fire Alarm Central Station.	
◻		Automatic Fire Alarm Device.	
◻		Watchman's Station.	
◻		Watchman's Central Station.	
◻		Horn.	
◻		Nurse's Signal Plug.	
◻		Maid's Signal Plug.	
◻		Radio Outlet.	
◻		Signal Central Station.	
◻		Interconnection Box.	
		Battery.	
----		Auxiliary System Circuits. Line without further designation indicates 2-wire circuit. For a number of wires designate as: 12-No. 18W-¾"-C.; or by number as in schedule.	
◻ _{a,b,c}		Special Auxiliary Outlets. Letters refer to notes on plans or details in spec.	

Heating and Air Conditioning. In Fig. 48 the more common symbols used to represent heating and air-conditioning units are illustrated. Pipe symbols (solid and dash lines) are shown on plan views. Circular and rectangular symbols are always drawn in the walls or partitions. The rectangular symbols are made narrower than the walls or partitions so they can be more easily seen. Sometimes arrows are used with them to show the direction of the air flow.

Note the radiator symbols in Figs. 31 and 46. In small houses, steam or hot-water pipes are seldom shown on the drawings, as the design of these systems is left to the heating contractor.

Fig. 49 was drawn to illustrate how gravity, forced air, and air-conditioning pipes, or ducts, are indicated in plan views; therefore no other material symbols, such as concrete or brick, are shown. Such special drawings are necessary because there is seldom enough room to draw all the ducts in addition to other structural symbols.

The basement plan in Fig. 49 gives the layout of the horizontal ducts which run along the ceiling before connecting with the vertical stacks. The dimensions specify the size of the ducts, and we always assume that the greater dimension is parallel to the ceiling.

The first-floor plan in Fig. 49 illustrates how the hot- and cold-air symbols are shown in walls and partitions.

The notations *in joist* and *between joists* indicate that the duct is between two joists and thus not hanging down below the basement ceiling line. The dash lines, as shown in Fig. 48, indicate cold-air ducts.

Electrical. The common electrical symbols used for floor plans are shown in Fig. 50. Note examples of these symbols in Figs. 31 and 46.

Miscellaneous. The miscellaneous symbols in Fig. 51 are self-explanatory. They are used in plan views as the occasion demands.



Fig. 51. Miscellaneous Symbols

Refrigerators, gas stoves, cupboards and similar furnishings are shown on plan views by squares or rectangles, in the shape of the object represented. These are illustrated in Fig. 31.

Sometimes walls and partitions are shown in solid black or in color. Such symbols are rarely used, however, except where plans are printed in magazines or newspapers and are designed more for display purposes than for actual use by mechanics in construction work.

QUESTIONS AND ANSWERS

The following questions and answers are included as a short review of what has been covered thus far in blueprint reading. Answer each question and then check your accuracy by the answer given.

1. How many windows are indicated in Fig. 31?

Answer. There are six window symbols shown.

2. Name the kind of windows indicated in Fig. 31.

Answer. All symbols show that double-hung windows are required.

3. How many stairways are indicated in Fig. 31?

Answer. The stair symbol shows a zigzag line. This indicates that there are to be two stairs, one to the basement and one to the second floor.

4. How can we determine which of the stairs shown in the stair symbol goes up to the second floor?

Answer. An arrow and the word *up* at the south end of the stair symbol indicate which stairs go to the second floor.

5. What kind of flooring is to be used in the kitchen in Fig. 31?

Answer. The specifications printed on Fig. 31 call for a maple floor, linoleum-covered.

6. How many closets are shown in Fig. 46?

Answer. Studying the plan, we see that the abbreviation *CLOS.* appears three times; thus, there are three closets. They are also indicated by the small inclosures.

7. How many and what plumbing fixtures are specified in the bathroom of Fig. 46?

Answer. There are three fixtures—a bath tub, a water closet, and a wash basin.

8. What symbol is used for a concrete floor on a plan view?

Answer. There is no such symbol. The specifications must give this information.

9. How is the interior dimension of a room obtained when not specifically shown on the plans?

Answer. Generally, as in Figs. 31 and 46, only exterior dimensions are shown on the plans. To determine the interior dimensions, subtract the wall thicknesses from the exterior dimensions.

10. How are dimension lines to interior partitions shown?

Answer. Dimensions to all interior partitions are drawn so that the extension line is at the center of the partition.

11. Are all of the walls and partitions in Figs. 31 and 46 of the same thickness?

Answer. No. The east wall of the kitchen, and bathroom, is 8" thick. The partition between the linen closet and the closet of bedroom No. 1 is only 4" thick, whereas all other walls and partitions are 6".

12. What access is provided to the attic space over the main portion of the house?

Answer. In the second-floor hall a scuttle is specified. This is a framed opening in the ceiling having what might be referred to as a horizontal door. This door can be pushed upward and access to the attic gained by the use of a ladder.

13. How many flues has the chimney?

Answer. There is one square opening in the chimney symbol. This indicates one flue.

14. What are the over-all dimensions of the house?

Answer. Fig. 31 shows the length as 27' 3" and the width as 25' 0".

15. Do other floor plans give the length and width of the house?

Answer. Yes, the second-floor plan, Fig. 46, shows exactly the same dimensions.

16. What is the interior size of the closet for bedroom No. 1?

Answer. The dimensions which show the length have extension lines running to the center of the two end partitions. These are 6" and 4" partitions; so we deduct 3 inches from one and 2 inches from the other of the dimensions shown and have 2'0" and 1'5". Combining these, we have $2'0" + 1'5" = 3'5"$ as the length. The dimension giving the depth is shown outside the west wall. Its extension lines also run to the centers of the partitions; so as these are 6" walls, we deduct 6" altogether from the given dimension. Thus the closet is 3'5"x2'6".

17. How are window locations dimensioned?

Answer. Note the south window in the living room. The extension line for one end of the dimension is drawn through the center line of the window. The extension line for the other end of the dimension is at the outside corner of the house.

18. Is the first-floor level above the level of the garage floor?

Answer. Yes. This fact is shown by the steps just outside the front door. The arrow points to the door and crosses two lines, each line representing one riser; therefore, the first-floor level is two steps above garage-floor level.

19. What might happen if the foundations for a house were built without footings, on soft ground?

Answer. The weight of the house on the foundations might cause settling in one or more places, which would result in cracks and other undesirable effects.

20. How far apart are the two windows on the west side of the first floor, measuring from the center of each window?

Answer. The dimension along the west side shows that the center lines of the windows are 13'0" apart.

21. What size is the front door?

Answer. Note the number in the circle near this door. Locate the same number in the door schedule on the second-floor plan, Fig. 46. This gives the size as 3'0"x7'0".

22. Is the stairway to the second floor visible from the living room?

Answer. Yes. There is no partition symbol on the living room side of the stairs, so the stairway is open.

23. How many radiator symbols are shown in Figs. 31 and 46?

Answer. Seven radiator symbols are shown.

VISUALIZING ELEVATIONS

If we take a picture of a house we may obtain a view something like Fig. 30. Such a picture shows exactly how two sides of the house appear. However, photographs of a house to be remodeled will not help us visualize the finished job; therefore, we must make drawings to take the place of a photograph, so that the mechanics can see what the remodeled house is to look like. Such drawings are called *elevations*.

A person with very little knowledge of blueprint reading can look at the elevations and obtain a fairly accurate idea as to the appearance of the house they represent. There are, however, some symbols and principles which must be mastered before elevation views can be clearly understood.

After the floor plans have been drawn and the windows and doors have been shown in their proper places, we have something upon which to base an elevation. From this point on, the development of the elevation drawings is carried on slowly, by trying for various effects, until we have portrayed on paper the house we pictured in our minds.

An elevation is a view of *one side* of a house. Thus, *four* elevation views are necessary in order to show what a house is to look like when remodeled. To draw an elevation view, we must imagine we are look-

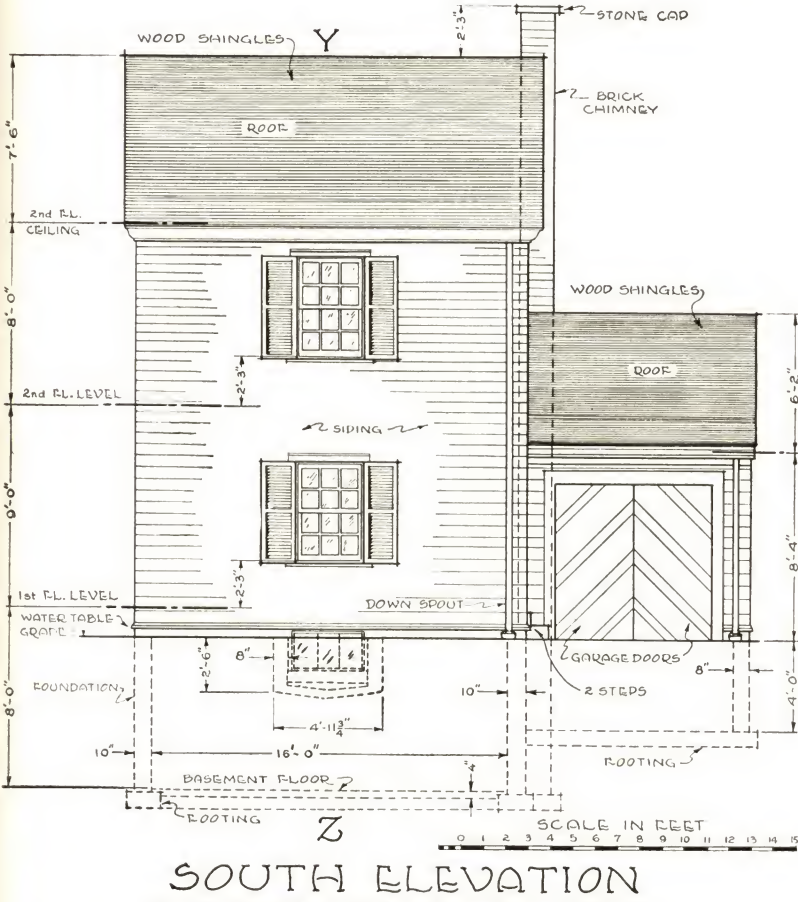
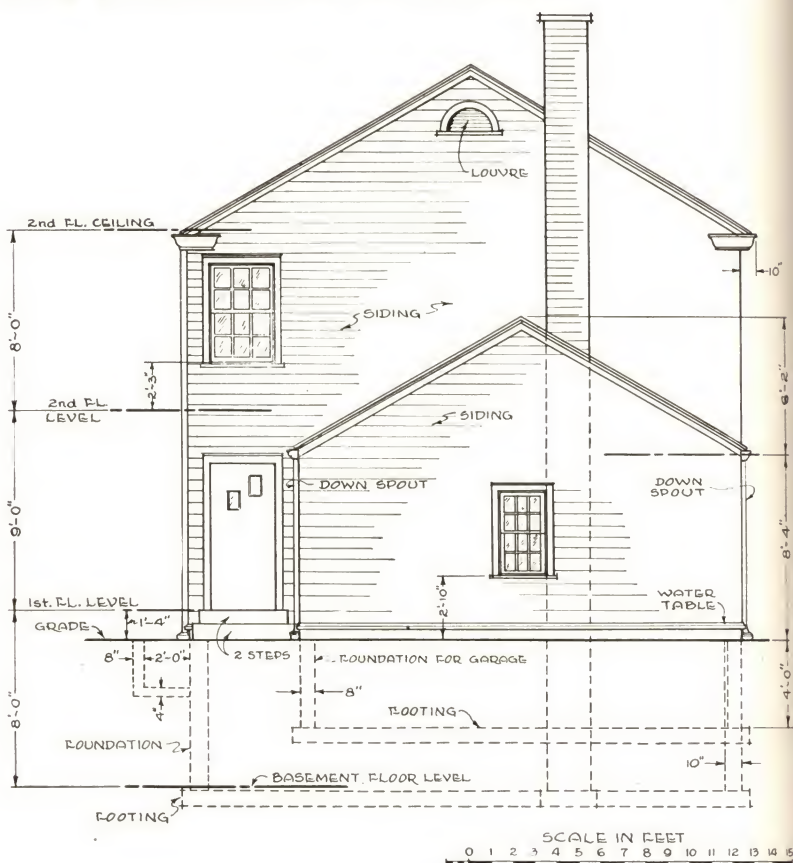


Fig. 52. South Elevation View of House Shown in Fig. 30

ing at one side of the house. We must have a complete mental picture of the house before making the drawings.

In Fig. 30 we can see a front view of the house, showing the windows, roof, garage door, and chimney. Studying Fig. 52, we note that this elevation shows everything which is visible on the front side of the house in Fig. 30 and, in addition, symbols and other structural information.

Fig. 30 also shows the right side of the house. Study Fig. 53 and note that this elevation contains everything visible in the side view on Fig. 30, plus symbols and other information.



EAST ELEVATION

Fig. 53. East Elevation View of House Shown in Fig. 30

It should be kept in mind that the picture in Fig. 30 could not be made until after the elevations were designed. Fig. 30 is presented only that the reader may more easily visualize and understand what an elevation is.

SYMBOLS USED ON ELEVATION VIEWS. We have already studied the symbols used in plan views; now we will examine the com-

mon symbols used on elevation views. These should be memorized, also.

Walls. Fig. 33 illustrated the plan-view symbols for materials commonly used in the construction of walls. Fig. 54 shows the symbols used to represent these materials on elevation views. Frame walls ordinarily have either siding or shingles on the exterior surface. The symbol shown in Fig. 54 for siding, or the one for shingles, is drawn in the proper places on the elevations, either in patches or over the entire area. The concrete symbol for elevations is the same as for stucco and

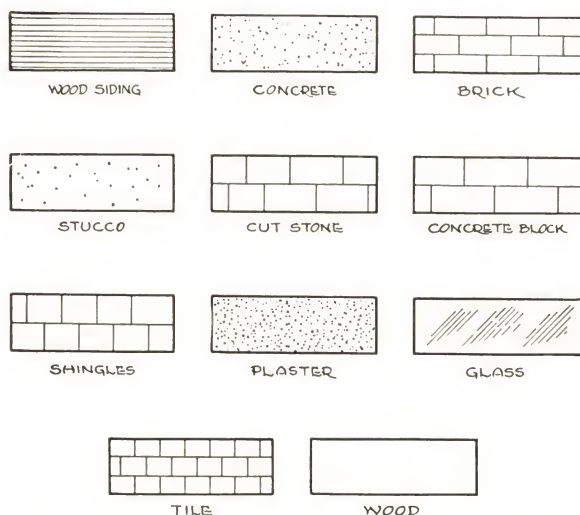


Fig. 54. Typical Wall Material Symbols for Elevation Views

plaster. When this symbol is used to indicate any of these materials, the name of the material should be printed on the drawing in one or more places. Symbols for brick, concrete block, cut stone, and shingles are similar, the difference being that the brick symbol is smallest, shingles are larger, and cut stone and concrete block largest. Here again the name of the material indicated should be printed on the drawing. Frequently, draftsmen draw parallel lines to represent bricks or shingles, since, if drawn according to scale, the space between the lines is too small to indicate individual bricks or shingles. (See the roof, Fig. 52.) The glass symbol is shown in very small patches in one or more panes of glass in windows or doors. The tile symbol differs little from the symbols for brick, shingles, and con-

crete block. Wood frames for doors or windows and wood trims are left blank and must be supplemented by descriptions in the written specifications as to the kind of wood.

Footings. Footings are shown in elevation views by dotted lines as illustrated in Figs. 52 and 53.

Windows. From Fig. 36 we learned the plan-view symbols for typical windows. Fig. 55 shows the elevation symbols for the same windows. They are drawn to scale. Note that the symbol for wall material is indicated around the window symbols. These symbols

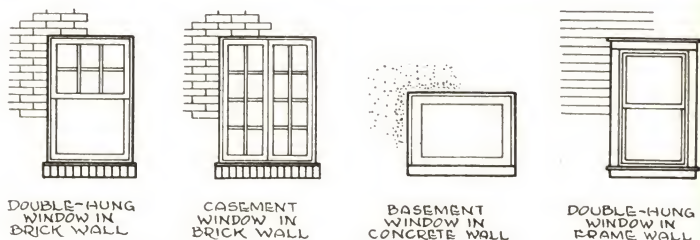


Fig. 55. Typical Window Symbols for Elevation Views

show windows just about as they appear in actual houses. Symbols for double-hung windows may be drawn with single panes of glass in each half of the window or with smaller panes, as required.

Doors. Doors vary greatly in their general design. A door symbol is drawn to illustrate the design of the particular door it represents, and hardware such as handles, knobs, and butts can be shown if desired. Typical elevation symbols for doors in various kinds of walls are shown in Fig. 56. These symbols are related to the plan symbols shown in Fig. 37.

Both window and door symbols are drawn to scale, so that the elevation view gives a true idea of proportion.

The broken parallel lines appearing in the folding-door symbol indicate that part of the drawing has been omitted. We can omit parts of drawings in this way when the omitted portions are exactly the same as the parts shown. This is done to conserve space on the drawings.

In Fig. 56 note the other symbols such as brick, plaster, and wood.

Stairs. A typical elevation view of stairs is shown in the lower right-hand corner of Fig. 40. The symbol is drawn exactly as the

stairs are to appear. You will notice that many elevation symbols are like pictures of the things they represent. The reason for this is that the symbols are used as patterns, we might say, in addition to showing kinds of material. For example, the stair elevation symbol shows the

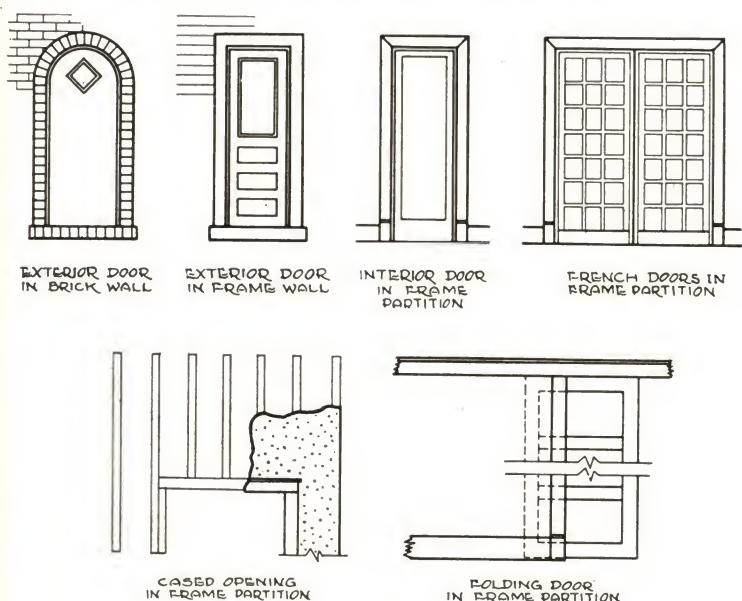


Fig. 56. Typical Door Symbols for Elevation Views

shapes of the newel post, treads (*C*), balusters (*P*), and handrail, as they must be made.

In open-string stairs the ends of the treads and risers are visible, whereas in closed-string stairs partitions are placed at both ends of the treads and risers. Thus, in Fig. 40 the treads and risers at (*L*) are open string and can be seen; the treads and risers at (*M*) are closed string and cannot be seen. Again dotted lines are used to indicate items (in this case treads and risers) which are invisible.

Fireplaces and Chimneys. Fig. 57 shows a combination of plan- and elevation-view fireplace symbols. Note that the elevation view shows the fireplace as it would actually appear.

The vertical dot-and-dash line which runs through the plan and elevation views is for the purpose of dividing the symbols to show the exterior appearance on the left side of the line and to give construc-

tion information on the right side. For example, in the plan view the symbol to the left of the dotted line shows exactly what we should see if the chimney were cut (as the house was cut in Fig. 32) and the top part moved away. The right side shows the wood joist framing around the fireplace and chimney. In the elevation view, the left side

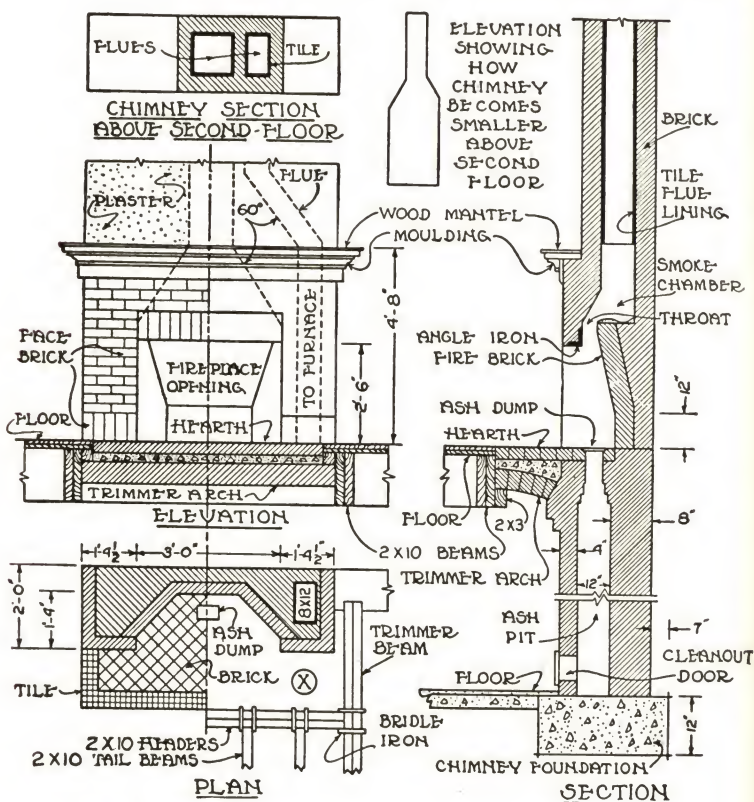


Fig. 57. Fireplace and Chimney Symbols in Plan and Elevation Views

of the symbol shows a typical fireplace as it would actually appear. Notice the brick and plaster symbols. Sometimes fireplaces are made of stone, in which case the stone symbol would be shown in place of the brick symbol. On the right side of the elevation view, the brick and plaster symbols were omitted in order to show the dotted lines which indicate the position of the furnace flue. Just above the elevation view is a symbol showing both fireplace and chimney flues. The

small elevation view of the chimney (at top center of Fig. 57) shows how the chimney becomes smaller above the second-floor level.

Note the various symbols for brick, tile, wood, concrete, and flue lining shown in Fig. 57. At the right is a sectional view of the chimney and fireplace. If the chimney is built as an "outside chimney," it juts out beyond the rest of the wall and can be seen on the elevation view of the house.

Views of other parts of the house (cupboards, buffets, etc.) are often shown in a similar manner in order to instruct the mechanics regarding their design and appearance.

Areaways. On elevation views, areaways are shown as illustrated in Fig. 52. The symbols are drawn to scale and show the wall thickness, the width, and the depth of the areaway. Dotted lines are used because the walls are below ground level and thus are invisible.

Foundations. Fig. 52 also illustrates how foundations and basement floors are shown in elevation views. Here again dotted lines are used because the foundations and floor are below ground level and, thus, invisible.

Interiors. Sometimes elevation views of the interior walls are drawn for one or more rooms to show the exact positions of doors,

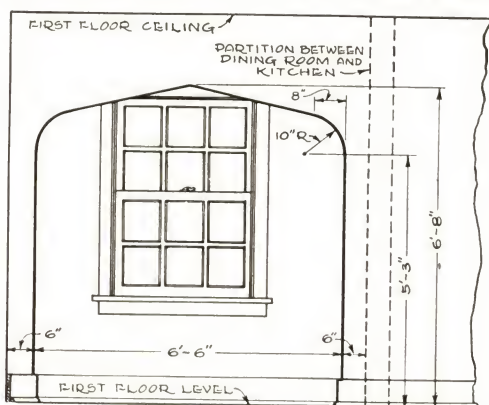


Fig. 58. Elevation View Showing Arch Between Living Room and Dining Alcove for House of Fig. 31

windows, and built-in features. In such cases the elevations are drawn just as though they were pictures of the walls and the details on these walls. Fig. 58 is an elevation view of part of the north wall of the living room, Fig. 31, including the arch into the dining room or alcove.

and showing the dining room window. Note that the arch is fully dimensioned. Every part of these interior elevations must be drawn carefully to scale.

QUESTIONS AND ANSWERS

The following questions and answers are proposed as a short review of the principles of elevation drawings.

1. How are the dimensions obtained for the footings used under the foundation?

Answer. See Fig. 52. No dimensions are shown. Cases like this are frequent, both in plan and elevation views, because it is not always possible to show all dimensions, due to lack of space. However, we know from the scale specifications that the drawing was made to the $\frac{1}{4}"$ scale, and we can easily find the missing dimensions by scaling, as previously instructed.

2. What is the thickness of the main foundations? What is the depth?

Answer. The dimension on the foundation symbol shows that the width is 10". The depth of the foundation cannot be ascertained from this drawing because the vertical dimension extends up to the first-floor level, and the drawing does not show the floor construction. Such a question must be answered by the use of section drawings, which are explained in succeeding pages.

3. What are the dimensions for the areaway walls?

Answer. Fig. 52 shows complete dimensions near the areaway symbol. Depth is 2'6", width is 4'11 $\frac{3}{4}"$, and wall thickness is 8".

4. Is the area under the garage excavated?

Answer. No. The foundation under the garage is shown as being only 4'0" deep, which indicates that no excavation is required. The footing foundations are just deep enough to be below frost level in the ground.

5. What thicknesses have the various concrete walls?

Answer. Both Figs. 52 and 53 show that the main foundations are 10" thick, that areaway walls are 8" thick, and that the garage foundations are 8" thick.

6. What information is shown relative to the basement floor?

Answer. In Fig. 52 the depth of 4" is given. The written specifications should explain that concrete is required.

7. What is the distance between the first and second floors?

Answer. Fig. 52 shows that the distance is 9'0".

8. How high above the floor are the window sills?

Answer. Fig. 52 shows that the window sills are 2'3" above the floor lines.

9. Name the kind of windows required for the south elevation.

Answer. The symbols indicate that double-hung windows are required and that each half window has 6 panes of glass.

10. What is the material for the outside surface of the walls?

Answer. The symbol and written specification indicate siding.

11. What type of shingles is required?

Answer. The symbol and specification in Fig. 52 specify wood shingles.

12. Do all windows have shutters?

Answer. No. Only windows shown on the south elevation have shutters.

13. Are any downspouts indicated?

Answer. Yes. Both south and east elevations show downspouts by specification and by actual drawings.

14. How high is the ridge of the garage roof above grade?

Answer. The dimensions in Fig. 52 add up to 14'6".

15. How high is the chimney top above first-floor level?

Answer. Adding the dimensions shown on the left side of Fig. 52 to the dimension from the ridge to the chimney top gives 26'9".

VISUALIZING SECTIONS

In addition to plan and elevation views, it is necessary to use another type of drawing to show the inside details of various struc-



Fig. 59. Zigzag Lines Indicate That Not All of an Item Is Shown

tural assemblies. For example, plan views might show that a wall is frame, and elevation views might show that wood siding is used as the outside surface, but neither of these drawings would show how the inside of the wall is made, nor the materials used there. Interior dimensions are lacking, also. The same thing holds true for other walls, for floors, fireplaces, chimneys, and roofs. In fact, almost all parts of a house require the use of sectional drawings to show the necessary information.

While studying plans and elevations, we learned that solid lines are used to show the outside edges or surfaces of walls, windows, doors, chimneys, and other structural details. Also, we learned that dotted or dash lines are used to indicate things which are hidden. Zigzag line symbols, as illustrated in Fig. 59, are used when part of the object is not shown in a drawing.

REFERENCE LINES. Another type of line is used to indicate where a sectional view is to be made or visualized. This line is called a reference line and is illustrated in Fig. 60. Reference lines are used



Fig. 60. Reference Line

to show where part of a structure is cut, so to speak, in order that a section of it can be drawn to show details.

A section can be illustrated by cutting an apple or an orange in half. If we cut across an apple, we see the skin, the meaty portion, and the core where the seeds are found. If we cut the orange in half, we are able to see the peel, the various sections into which the orange is divided, and the core in the center. This cut surface that we look at is a section.

STAIRS. Now refer back to Fig. 40. Note the reference line (A) which is drawn through the newel post at the foot of the stairs. Imagine cutting through the newel along this line, moving the top part away, and looking down on the bottom part. The section (A) near the upper right-hand corner of Fig. 40 shows what we should see. The newel is 6" square and is made of 4 pieces of wood, each of which is $\frac{7}{8}$ " thick. Even the manner of joining the pieces is shown.

Next, note the reference line (B) which is drawn through the handrail in Fig. 40. Then study the section marked (B), just above the upper end of the handrail. This shows the shape and dimensions.

(G) in Fig. 40 is a section which shows how the risers and treads are put together, indicates that they are made of wood, and gives some of the dimensions.

FIREPLACE AND CHIMNEY. Refer again to Fig. 57. The right half of this drawing shows a section of the fireplace and chimney. The reference line, indicating where the fireplace and chimney were presumably cut in order to show this sectional view, is drawn through the center of the plan and elevation views. Note the various symbols used in the section. From a drawing such as this, details of construction, materials, and dimensions can be determined.

WINDOWS. Fig. 61 shows a picture-like view of the various parts of a window. This drawing is not the kind that would be shown in a set of blueprints and is used here only to help you understand what a section is.

Fig. 62 is the type of sectional drawing which would be shown in a set of blueprints. The vertical reference line divides the window in

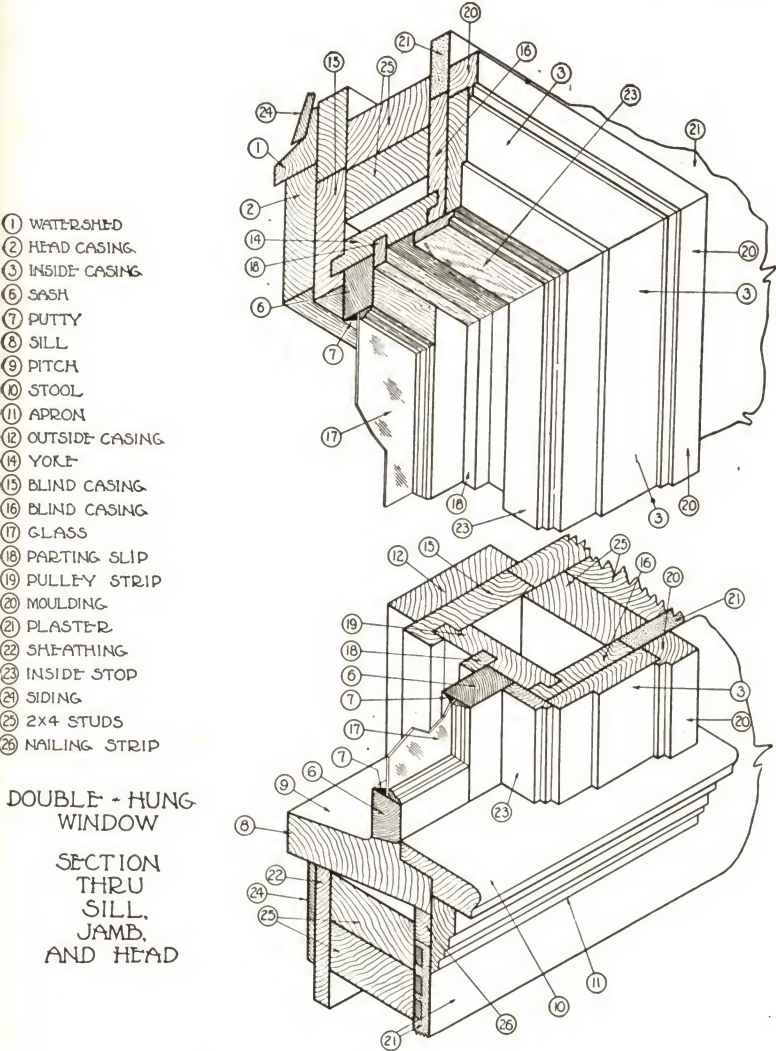
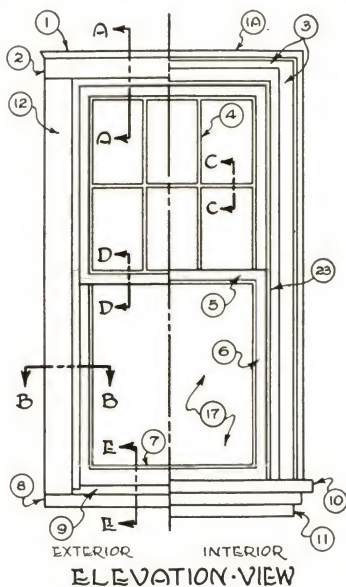


Fig. 61. Picture of Double-Hung Window Casing

half so that both exterior and interior views may be shown. Note the reference line at AA. Then note the drawing showing section AA. This is what we should see if we cut through the window at AA,

moved one part away, and looked at the cut surface of the remaining part. Sections for reference lines *BB*, *CC*, *DD*, and *EE* can be studied



- | | |
|-------------------|---------------------|
| (1) WATER SHED | (12) OUTSIDE CASING |
| (1A) MOLDING | (13) WEIGHTS |
| (2) HEAD CASING | (14) YOKE |
| (3) INSIDE CASING | (15) BLIND CASING |
| (4) MUNTIN | (16) BLIND CASING |
| (5) MEETING RAIL | (17) GLASS |
| (6) SASH | (18) PARTING STRIP |
| (7) PUTTY | (19) PULLEY STRIP |
| (8) SILL | (20) MOLDING |
| (9) PITCH | (21) PLASTER |
| (10) STOOL | (22) SHEATHING |
| (11) APRON | (23) INSIDE STOP |

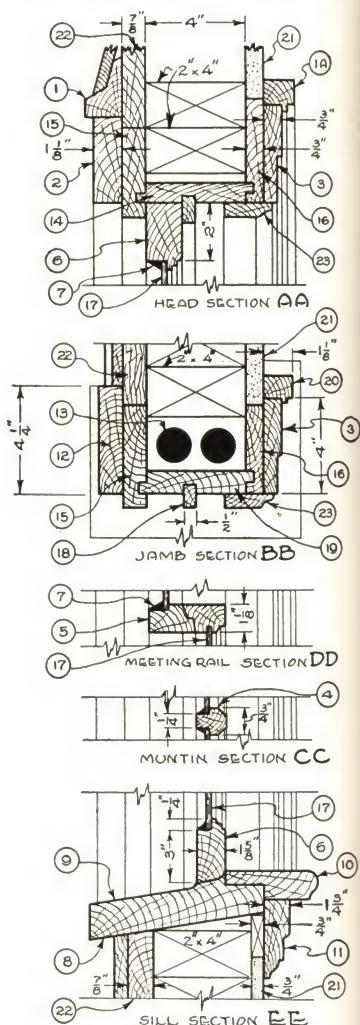


Fig. 62. Elevation and Section Views of Double-Hung Window

in like manner. Note the material symbols, shapes of parts, and dimensions.

In Fig. 63 various typical items are shown in elevation and section views. For the door, note reference line *AA*; Section *AA* is below.

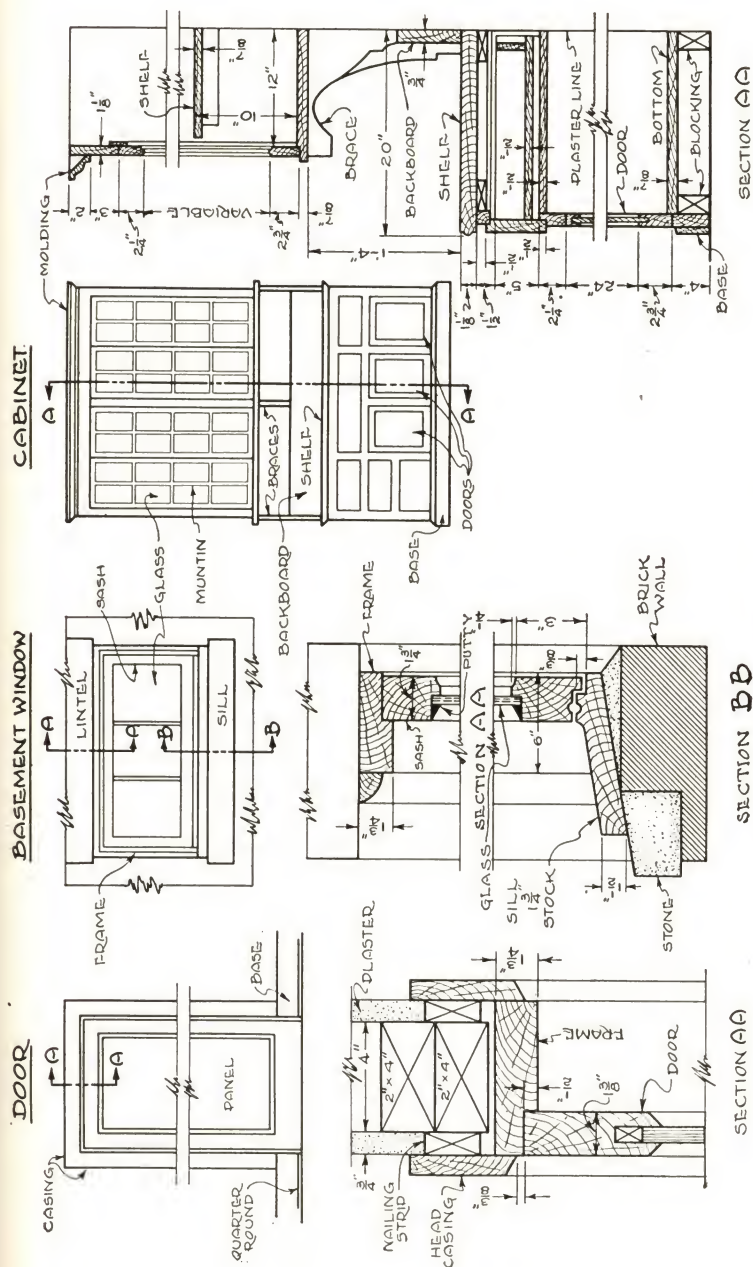
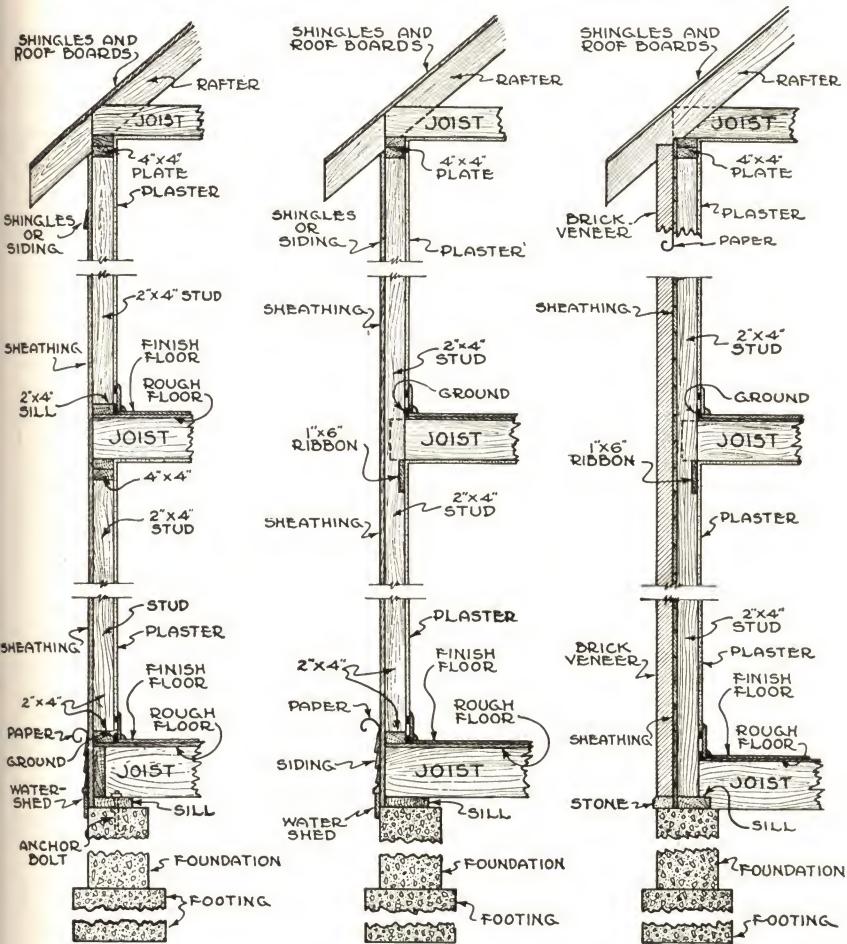


Fig. 63. Typical Sectional Views

For the basement window note reference lines *AA* and *BB* and the corresponding sections below.

On the cabinet, the reference line *AA* presumably cuts through to the back of the cabinet, so that the sectional view can be seen.



Notice that in all of these sections the shapes and kinds of materials, methods of construction, and dimensions are given. Very little of such information could be shown on plan or elevation views.

WALLS. Refer to Fig. 52 and imagine that a reference line connects *Y* and *Z*. Further imagine that along this line we could cut the

house through, move one part away, and look at the cut surface of the walls in the remaining part. Fig. 63A illustrates the wall section which we should see. This drawing shows dimensions, shapes of all

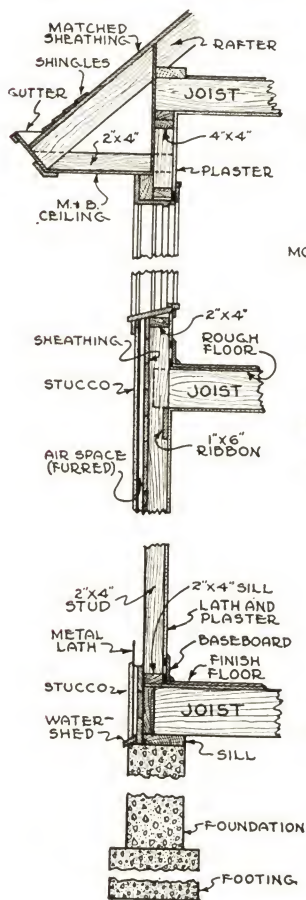


Fig. 67. Stucco Wall

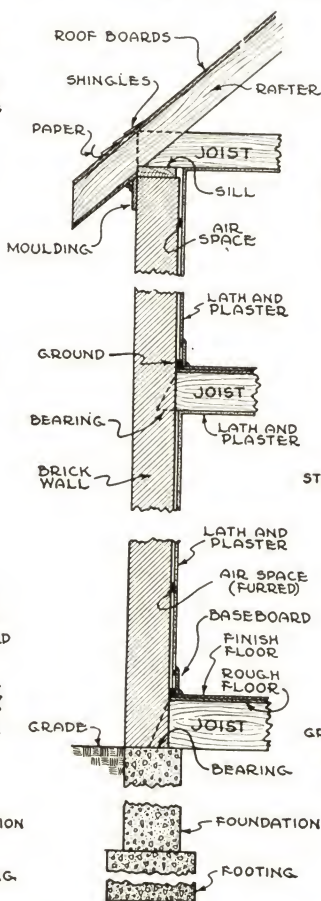


Fig. 68. Brick Wall

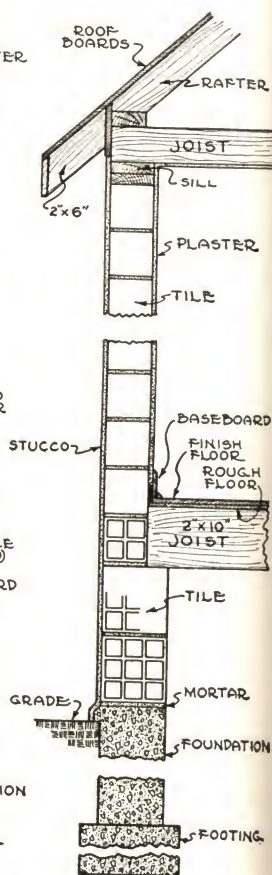


Fig. 69. Tile and Stucco Wall

parts, material symbols, and much other information which could not be shown on plan or elevation views. Some of the specific items shown by this section are: wall and floor insulation, sheathing, wood shingles and siding, inside wall finish, floor construction, footings, basement floor, water table, areaway, vertical dimensions, sizes of joists and rafters, sills, plates, window section, interior trim, gutters, roof construction, and roof insulation. The section also indicates the

grade. Names of parts, including moldings, headers, and anchor bolts, are given.

Fig. 63A is a frame wall. There are many variations of frame walls, but all would be drawn in section according to these same principles. Each part should be drawn accurately to scale. Often, zigzag lines, with a small space between, may be used to represent the same construction continued over a greater space.

Figs. 64, 65, 66, 67, 68, and 69 illustrate various types of walls.

TILE FLOORS. Bathrooms often have tile floors. The required construction of such floors can best be indicated by the use of sec-

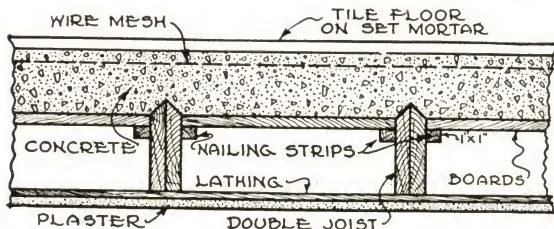


Fig. 70. Section View of Tile Floor

tional drawings. Fig. 70 shows a typical section for such a floor with its double framing, concrete, and wire mesh.

STANDARD SIZES OF LUMBER

Lumber which is supposed to have been properly seasoned is kept in stock by most material dealers. It is usually furnished in certain standard sizes and classified according to the size of the pieces, as shown in Table 1.

Lumber known as *dimension stuff* is 2" thick and from 4" to 12" wide as it comes from the saws. The narrower sticks of dimension stuff are often called *scantlings*, and the wider ones *planks*.

Timbers are from 4" to 8" thick and from 6" to 10" wide.

Common boards are 1" thick and from 4" to 12" wide.

These are the three standard types of rough lumber and their nominal sizes. However, when the lumber is smoothed up or *dressed*, about $\frac{1}{8}$ " is taken from the sides and edges of the thinnest pieces, and from $\frac{3}{8}$ " to $\frac{1}{2}$ " is taken from the sides and edges of the thickest pieces. This smoothing process is called *surfacing*, or *dressing*, and the letters *D* for dressed or *S* for surfaced are used with figures to

show how many sides and edges of each piece are to be dressed or surfaced. Thus *D.I.S.* or *S.I.S.* means dressed or surfaced on one

Table 1. Standard Sizes of Lumber

Conforming with the recommendations of the Lumber Industry as set forth in Simplified Practice Recommendations No. 16 published by the United States Department of Commerce.

Type of Lumber	Nominal Size		Actual Size S4S At Comm. Dry Shp. Wt.	
	Thickness Inches	Width Inches	Thickness Inches	Width Inches
Dimension	2	4	$1\frac{5}{8}$	$3\frac{5}{8}$
	2	6	$1\frac{5}{8}$	$5\frac{5}{8}$
	2	8	$1\frac{5}{8}$	$7\frac{1}{2}$
	2	10	$1\frac{5}{8}$	$9\frac{1}{2}$
	2	12	$1\frac{5}{8}$	$11\frac{1}{2}$
Timbers	4	6	$3\frac{5}{8}$	$5\frac{1}{2}$
	4	8	$3\frac{5}{8}$	$7\frac{1}{2}$
	4	10	$3\frac{5}{8}$	$9\frac{1}{2}$
	6	6	$5\frac{1}{2}$	$5\frac{1}{2}$
	6	8	$5\frac{1}{2}$	$7\frac{1}{2}$
	6	10	$5\frac{1}{2}$	$9\frac{1}{2}$
	8	8	$7\frac{1}{2}$	$7\frac{1}{2}$
Common Boards	1	4	$\frac{25}{32}$	$3\frac{5}{8}$
	1	6	$\frac{25}{32}$	$5\frac{5}{8}$
	1	8	$\frac{25}{32}$	$7\frac{1}{2}$
	1	10	$\frac{25}{32}$	$9\frac{1}{2}$
	1	12	$\frac{25}{32}$	$11\frac{1}{2}$
Shiplap Boards	1	4	$\frac{25}{32}$	$3\frac{1}{8}$ face
	1	6	$\frac{25}{32}$	$5\frac{1}{8}$ face
	1	8	$\frac{25}{32}$	$7\frac{1}{8}$ face
	1	10	$\frac{25}{32}$	$9\frac{1}{8}$ face
	1	12	$\frac{25}{32}$	$11\frac{1}{8}$ face
Tongued and Grooved Boards	1	4	$\frac{25}{32}$	$3\frac{1}{4}$ face
	1	6	$\frac{25}{32}$	$5\frac{1}{4}$ face
	1	8	$\frac{25}{32}$	$7\frac{1}{4}$ face
	1	10	$\frac{25}{32}$	$9\frac{1}{4}$ face
	1	12	$\frac{25}{32}$	$11\frac{1}{4}$ face

side, and *D.I.E.* or *S.I.E.* means dressed or surfaced on one edge. *S.4.S.* means surfaced on both sides and on both edges, while *S.I.S.I.E.* means surfaced on one side and one edge.

QUESTIONS AND ANSWERS

The following questions and answers serve the purpose of a short review of the principles of sections. The questions are relative to the house of Figs. 31, 46, 52, 53, 63, and 63A.

1. How high is the basement ceiling above the basement floor?

Answer. Fig. 63A shows that the height of the basement ceiling is 7'0½".

2. How are first-floor joists supported?

Answer. Fig. 63A shows that the foundation near the top narrows from 10" to 7". This leaves a ledge of 3" which supports the joists.

3. How are second-floor joists supported?

Answer. Fig. 63A shows that the second-floor joists are supported by a plate, made up of two 2x4's, which in turn is supported by the 2x4 studs.

4. How are the rafters and second-floor ceiling joists supported?

Answer. There is a plate made up of two 2x4's, supported by the 2x4 studs, which serves as a support for both the rafters and the joists.

5. What type of sheathing is used?

Answer. Sheathing is nailed to the outside edge of the studs. There is a specification in Fig. 63A which indicates that the sheathing is composed of insulating board.

6. How is the bottom sill of the framing held in place?

Answer. In the top of the foundation in Fig. 63A an anchor bolt is shown. This passes through the sill, is secured by a nut, and holds the sill in place.

7. How is rain water prevented from seeping into the space between the top of the foundation and the bottom sill?

Answer. Fig. 63A shows a water table which covers the crack between concrete and sill and which has a drip cap extending out from the wall about 2". This causes the rain water which runs down the wall to drain away from the wall surface.

8. What is the roof construction?

Answer. The rafters are 2"x6" and are spaced 16" apart, measuring from the center of one rafter to the center of another (on center or O.C.). An insulating board is nailed to the top of the rafters. Then 1"x4" strips of wood are nailed over the insulation, and the shingles are nailed to these.

9. What is the floor construction?

Answer. Both first and second floors have 2"x10" joists spaced 16" O.C., and insulation board is nailed to the tops of the joists. Over the insulation, rough flooring is nailed, and the finish flooring is nailed to that.

10. How is the distance from the first floor to the ceiling figured, using Fig. 63A?

Answer. The distance from the first to the second floor is shown as 9'0". The thickness of the joist plus insulation plus rough and finish floors is about 11½". Therefore subtract 11½" from 9'0" to find the required distance.

11. What type of framing is shown in Fig. 63A?

Answer. Refer to Figs. 64 and 65 wherein the Western and Balloon types of frames are shown. In Fig. 63A the Western type is used because the 2"x4" studs, as in Fig. 64, are not continuous from the foundation to the roof.

VISUALIZING PLOT PLANS

A plot plan, as the words indicate, is a plan view of the plot of ground on which a house is situated. The word *plot* has the same

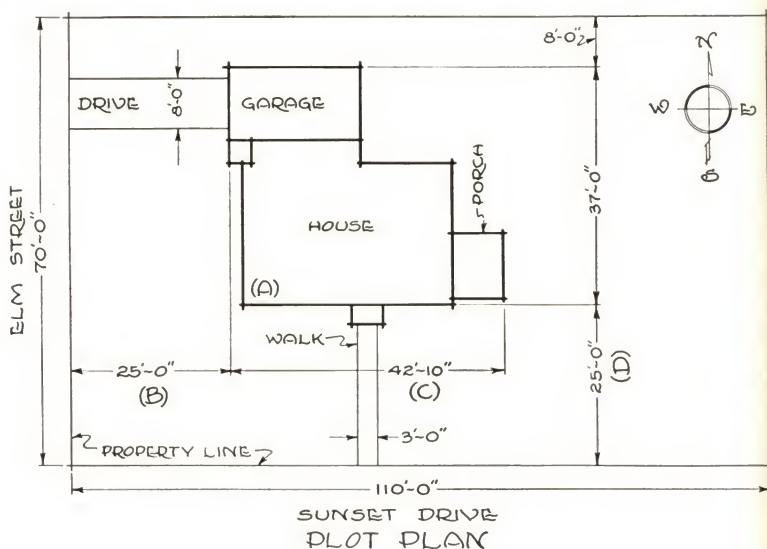


Fig. 71. Typical Plot Plan

meaning here as *lot*, or *site*. The word *plan*, as explained previously, means a view from above, or what you would see if you could look down on the plot. In visualizing plot plans, therefore, you must remember that such drawings represent the plot as seen from a point above the ground.

The most common type of plot plan is shown in Fig. 71. Notice that the outline of the plot is shown with the main or over-all dimen-

sions, and that the house, garage, and walks are indicated, with locating dimensions.

HOW PLOT PLANS ARE USED. The most common uses for plot plans are explained in the following paragraphs:

Location and Arrangement. In making plans for remodeling, a plot plan will assist in placing the house, and in locating the rooms, windows, doors, porches, garage, and walks to the best advantage. Draw an exact outline of the lot first. This will aid you in making a plan that will provide the best outlook, sunshine, air, and privacy for various rooms. Also it will indicate where the house should be placed in relation to gardens, lawn, driveway, and walks to make a good appearance from the street and to make good use of the available area.

Estimating. Plot plans are useful to masons, plumbers, and landscape gardeners in estimating material and labor costs for their part of a proposed remodeling job, because much of the information they require is shown only on the plot plans.

The mason contractor determines the amount of excavation, total driveway and walk areas, and other required masonry work from the dimensions and symbols given in the plot plans. In Fig. 71, for example, the position of the house is indicated by the dimensions at *B*, *C*, and *D*. With this information, plus more detailed dimensions from the basement plan, the mason can figure, after a visit to the site, the exact amount of excavation. The drive is 8'0" wide and 25'0" long; the walk is 3'0" wide and approximately 25'0" long. From these dimensions the mason determines the total areas to be concreted.

The plumbing contractor must know the distance from the house to the property line in order to figure labor and materials for sewers, drain tile, and water pipes. The exact distance from the house to the property line (25'0" in Fig. 71) is added to the distance from the property line to the sewers and water main to give the lengths of the trench and pipes.

In order to estimate the general landscaping details, the gardener (or whoever is planning the gardens and lawns) must know the exact position of the house, walks, and drives. Also, dimensions are required so that necessary materials and labor can be estimated.

Construction. When construction work begins, the mason contractor uses a plot plan to determine where the excavation and the corners of the foundations should be. For example, in Fig. 71, the

letter *A* locates the southwest corner of the house. If excavation were required here, the mason could find that point *A* is 25'0" north of the property line parallel to Sunset Drive and a little more than 25'0" east of the property line parallel to Elm Street. As the mason contractor is the first contractor on the job, you can understand the necessity for plot plans in this part of the remodeling work.

OTHER TYPES OF PLOT PLANS. Survey or location plans are sometimes used in place of the plot plans exemplified in Fig. 71. However, their use in remodeling work is infrequent unless the remodeling is extensive, involving great changes in the size and shape of the house and in the surface of the ground.

Survey Plans. A survey plan shows the exact heights of all corners of the lot and of many points within the lot. Such heights are in relation to a point of known height, called a *bench mark*. The purpose of these heights is to give a clear picture of the land, so far as slope, roll, and contour are concerned. The exact locations of trees are shown and dimensioned, also.

Location Plans. A location plan is similar to Fig. 71, except that the data included in survey plans are added. Sometimes designs for gardens and lawns are shown too, in which case the plan is also known as a landscaping plan.

TWO SETS OF PLANS

In remodeling work, two complete sets of plans should be used—one set of the old house before the remodeling, and one set to show the proposed remodeling. You will find that this practice has many advantages, among them the following:

1. Much more accurate planning of details, because the remodeled plans can be developed partially by tracing the original plans. This is explained fully in Chapter VI.
2. Easier and more complete visualization of the proposed changes, because the two sets of plans can be compared.
3. Greater accuracy and speed by the various mechanics, because by comparison of the two sets of plans they can more easily picture the structural changes.
4. Greater accuracy in estimating, because the estimators obtain a much clearer picture of what they have to do. This is to the advantage of the owner, because if estimators do not fully understand

all structural changes, they are likely to increase their estimates to take care of any items they are not absolutely sure about.

In drawing up the plan views and elevations, you should use the standard symbols explained in this chapter. The blueprints in the back of the book show remodeling plans in two sets, as recommended.

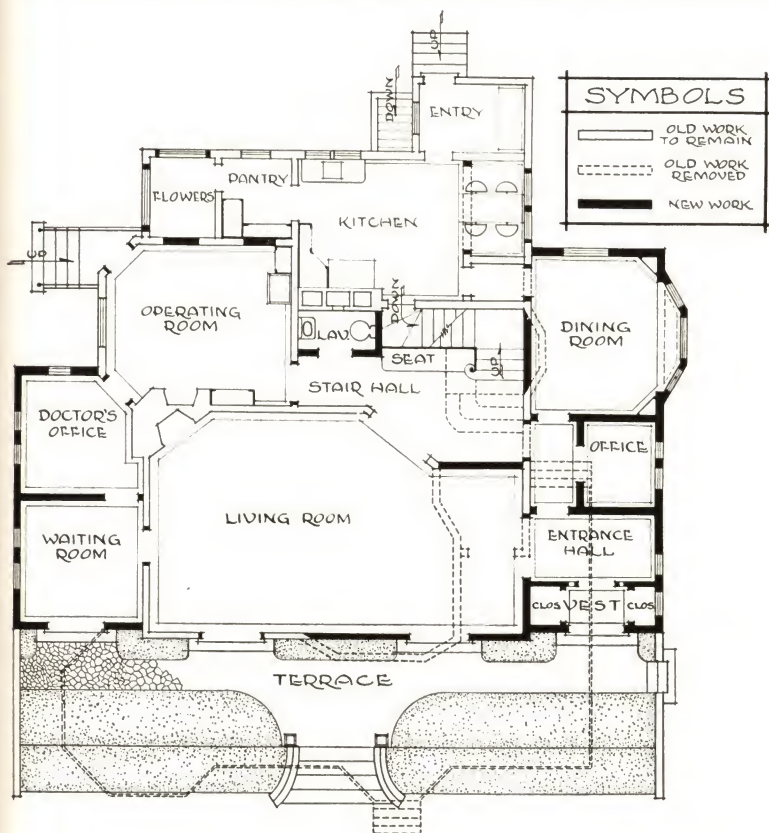


Fig. 72. Typical Remodeling Symbols on a Plan That Shows Both Old and New Work

Sometimes the old plans and the remodeling plans are combined into one set of plans. This practice is not recommended except in display drawings used in promoting remodeling work or for indicating roughly the changes to be made. In such instances, the symbols for walls and other details are used merely to indicate old and new portions, rather than to give complete directions.

Fig. 72 shows a floor plan, with typical symbols, drawn as de-

scribed in the foregoing paragraph. Notice that it is difficult to follow exactly the outline of the old plan, that no material symbols are shown, and that the drawing is not as useful or effective as the two sets of drawings contained in the blueprints in the back of the book.

Other symbols, including various types of shading, are sometimes used in drawings such as Fig. 72.

TERMS USED IN REMODELING*

The following are some of the terms that you are likely to encounter in the construction details of remodeling work. You will find it interesting and helpful to become familiar with them.

Aggregates. In mixing concrete, the stone used as a part of the mix is commonly called the coarse aggregate, while the sand is called the fine aggregate.

Air Conditioning. Heating or cooling, cleaning, and circulating air throughout the various rooms of a house. This term has been used erroneously in many cases, and it is wise to investigate air-conditioning equipment carefully to see that, in each case, advantages are actually as claimed. See further explanation in Chapter XIII.

Apron. A piece of wood (molding) used just under a window, on the interior side, to cover the edges of rough plaster.

Arch. This term generally refers to an opening, wider than a doorway, between two rooms. An arch may or may not be curved at the center point.

Ashlar. Stone, squared on all sides, that is used in foundations.

Balusters. The upright part of a stair railing which supports the handrail. Balusters are spindle-like and may be round or square in section.

Baseboard. A molding used where partitions and walls meet floors. Such moldings may consist of one, two, or three separate parts. See Fig. 63A.

Batter. This is a term applied to walls which slope from bottom to top, being thinner at the top than at the bottom.

Bay Window. A window forming a recess in a room and projecting outward. See blueprints in back of book.

Beam. This term applies to any large and long pieces of wood or metal, in a horizontal position, which support part of the floor or wall loads. Joists are beams. The horizontal iron or steel supports for floor joists, commonly seen in basements, are also beams.

Bibb. A faucet with threads to which a hose may be attached.

Bracing. A structural member used to help support vertical parts of framing.

Brick Veneer. One layer or thickness of brick laid, for example, against the sheathing in a wood frame.

Bridging. Pieces of wood or steel used between joists to keep them in proper position.

Building Paper. A form of paper prepared especially for construction work. It is used between rough and finish floors, and between sheathing and siding, as an insulation and to keep out vermin.

Cap. The top parts of columns, doors, and moldings.

Casements. Windows with sash that open on hinges.

*Courtesy of *Better Homes and Gardens*, Des Moines, Iowa.

Cement Blocks. Also *concrete blocks*. Blocks made of concrete. They are commonly used for walls and foundations.

Chase. A recess in masonry walls for pipes.

Cinder Blocks. Same as cement blocks except that cinders are used as the coarse aggregate. The advantage of cinder blocks is that they are lighter than blocks made with stone aggregates; however, they are not as strong.

Conduit. A term generally applied in electrical work to the pipes through which wires are run.

Coping. A covering or top for brick walls, usually made of tile.

Cornice. In general, this term applies to the construction under the eaves, or where roof and side walls meet.

Downspouts. Copper or galvanized sheet metal pipes used for carrying rain water away from roof gutters.

Eaves. That part of the roof which extends beyond the side wall.

Flagstone. This generally applies to irregularly shaped pieces of stone, which are split so they are from 1" to 3" thick. They are used for walks or terraces.

Flashing. Sheet metal—either copper or galvanized iron—used to prevent leakage of water around chimneys, gutters, over doors and windows, and in roof valleys.

Flitch Girder. A beam composed of two or more joists which have a $\frac{1}{4}$ -inch (or thicker) steel plate between them. Bolts are used to hold the joists and steel together. See specifications in Chapter III and blueprints in back of book.

Footing. Footings are generally made of concrete. They are used under foundations, chimneys, and columns to distribute the load over a greater area and thus prevent settlement.

Furring. Generally 1"x2" strips of wood which are nailed to masonry walls in vertical position, about 16" apart. Lathing is nailed to them providing an air space between wall and plaster. This helps insulate and keeps out dampness.

Girder. A beam used to support floor joists. May be built up of several joists spiked together, solid wood, or a steel I beam. See also Chapter VII.

Glazing. Placing glass in windows, doors, and mirrors.

Header. Around fireplaces, chimneys, and stair openings, a larger beam (generally two joists spiked together) should be used. Such a beam is called a header.

I Beam. A steel beam whose cross section resembles a letter I.

Jamb. The sides or lining of window and door openings.

Joists. Horizontal timbers which support floors and ceilings. See also Chapter VII.

Lally Column. A cylindrically shaped steel member used as a column to support girders and other beams.

Leader. Another name for downspouts.

Light. Another name for a pane of glass.

Lintel. Piece of wood or steel used over door and window openings to support the wall immediately above the openings.

Louvre. An opening for ventilating closed attics or other unused spaces.

Muntin (Mullion). The thin strip of wood or metal between the various lights or panes of glass in a window.

Pilaster. The term is sometimes applied where a foundation is enlarged for a short distance to form greater support for the end of a girder or beam.

Plates. Usually refers to 2x4's placed horizontally on the tops of studs in frame walls.

Rafters. The main structural members of a roof; used to support the shingles and roof boards.

Reread. The sides of a window opening or doorway, between the frame and the outside surface of a wall.

Ribbon. A board framed into the studs to support the ceiling or floor joists.

Ridge. Where the sloping parts of the roof meet. The highest point of a roof composed of sloping sides.

Sleepers. Strips of wood partially imbedded in concrete floors and used to create an air space between the surface of the concrete and the underside of the wood flooring which is nailed to the sleepers.

Soil Stack. In a plumbing system, the main vertical pipe which receives waste from all fixtures.

Stair Well. A compartment extending vertically through a building, in which stairs are placed.

Studs. Another name for the vertical 2x4's or 2x6's used in frame walls.

Waterproofing. The process of applying mortar, asphalt, or like materials to the outer surfaces of foundations, to prevent dampness.

Water Table. A projecting molding near the bottom of a wall used to direct rain water away from the wall. See Fig. 63A.

Note that many other terms can be learned by a careful study of the various drawings throughout the book.

READING A SET OF REMODELING PLANS

The following typical questions and answers refer to the set of blueprints in the back of the book. Study each question carefully and try to answer it yourself before you read the answer which follows. These questions will test how much you have learned about reading a set of remodeling plans.

Notice that the blueprints consist of two complete sets of plan and elevation views, as recommended, one set showing the *original* house and one set showing the *remodeled* house.

1. What type of outside walls is indicated in the original and remodeled plans?

Answer. Frame walls. The wall symbol consists of parallel lines with the space between the lines left blank, which, as explained previously, indicates frame construction.

2. What is meant by the term frame wall?

Answer. Explanations and illustrations given in this chapter show that a frame wall is composed of 2"x4" studs spaced 16" on center (O.C.), with lath and plaster on the inside, and sheathing and siding material on the outside.

3. What type of interior partitions is shown in the original first-floor plan?

Answer. Frame partitions are indicated by the same symbol as that used for the outside walls.

4. In what directions do the joists run in the original first-floor plan?

Answer. There is a joist symbol in the first-floor plan of the original drawing, to the right of the front entrance hall. This shows that the joists run east and west. The direction symbol is shown in the lower left-hand corner of the original first-floor plan.

5. What is the condition of the plaster in the kitchen of the original first-floor plan?

Answer. A printed specification in the kitchen area indicates that the plaster is badly cracked.

6. What type of door is shown in the original first-floor plan between the living room and the dining room?

Answer. The symbol shows a sliding or disappearing door.

7. How many chimneys are indicated in the original first-floor plan?

Answer. A fireplace is shown in the southwest corner of the dining room, which means one chimney. In the kitchen area another chimney symbol is shown, so there are two chimneys in all.

8. What type of columns support the first-floor girders visible from the basement?

Answer. In the original basement plan circles are shown in connection with the solid girder, indicating that the columns are 6" round wooden posts. A 4" wooden post is also shown.

9. Is all of the floor in the original basement plan concrete?

Answer. In the southeast and southwest corners of the basement plan the specifications indicate earthen floors. Therefore, only the north half of the basement has a concrete floor.

10. How many of the original basement windows have been omitted in the remodeled basement plan?

Answer. In the northeast corner of the remodeled basement plan one of the window openings is cross-hatched, indicating that it is to be filled in with brick and thus eliminated as a window opening.

11. Are any new footings specified for the remodeled basement?

Answer. A specification near the playroom fireplace symbol indicates that a new footing is to be constructed before the chimney is built. Also in the laundry and furnace room area there is a specification for a footing to help support the new 4" pipe column.

12. How are the inner foundation walls to be treated in the playroom, according to the remodeled basement plan?

Answer. In the upper right-hand corner of the remodeled basement plan there is a note specifying that the foundation walls in the playroom are to be furred with 1"x2" furring strips spaced 16" on center, over which lath and plaster are to be applied. Thus the foundation walls for the playroom are to be finished with lath and plaster the same as any of the first-, second-, or third-floor rooms.

13. What are the main changes or remodeling features in the basement plan?

Answer. The southern half of the basement has been redesigned as a playroom, and the northern half of the basement is to become a laundry and furnace room. Partitions between the playroom and the laundry and furnace room, plus the necessary door, keep the two areas separate and distinct. The stairway comes down from the first floor into a hall, from which one can go either to the playroom or to the laundry. A new fireplace has been provided for the playroom, also.

14. What are some of the features of the new playroom in the remodeled basement plan?

Answer. The fireplace is to have a quarry tile hearth which will be flush with the flooring. The playroom windows are to be two in number, one at the west and one at the east end. Steel sash are specified, and areaways outside the windows will allow more light and air to enter the playroom. The floor is to be concrete with sleepers, a hardwood floor, and linoleum surfacing. Four convenience outlets are provided in the playroom, and two fixture outlets in the ceiling. As already mentioned in another question, the walls are to be plastered.

15. What remodeling changes are indicated for the attic or third floor?

Answer. The southern half of the attic area is to be converted into a bedroom, a bathroom, and a closet. The northern half of the attic area is to remain unfinished, with the possibility of the addition of another room sometime in the future.

16. What bathroom facilities are provided for the third-floor bedroom in the remodeled third-floor plans?

Answer. Bathing facilities are taken care of by a shower bath, indicated by the proper symbol. There is also a regulation water closet and wash basin. The bathroom has a window at the extreme eastern end.

17. What remodeling changes are specified for the north, or back, elevation of the house?

Answer. The three first-floor windows on the left-hand side are to be removed, and in their place a new French door will be provided.

The old back porch and back-porch roof are to be removed and replaced by a small platform with a railing around it. The steps are to lead from this platform on the right-hand side as shown in the remodeled elevation view. The back door has been relocated, also.

On the second floor, near the left-hand side, two windows are to be provided in place of the one window shown on the original elevation.

The chimney shown on the original elevation is to be removed.

Also, a flagstone terrace 8'x14'6", with a railing around it, is to be constructed. This terrace is shown more in detail in the remodeled first-floor plan.

18. What changes are shown on the remodeled south, or front, elevation?

Answer. One window on the first floor at the left will be replaced by a new door. The old door is to be taken out, and the wall will be built up.

The steps shown in the original front elevation are to be reconstructed on the

left-hand side as shown in the remodeled elevation. The old roof of the porch will be replaced by a flat roof with a railing around it, as shown on the remodeled elevation.

Other than the changes just mentioned, the window arrangement in the remodeled south elevation remains the same as in the original.

19. What are some of the changes made in the remodeled east elevation?

Answer. The bay window on the first floor of the original east elevation has been removed, and windows, relocated from the old kitchen and pantry, are specified in its place. The window on the original first floor close to the right-hand corner has been removed.

On the second floor, also, the window close to the right-hand corner has been removed, and two additional windows have been specified, one to be relocated from the living room, the other from the pantry.

It will be noted too that a new-type steel-sash basement window, with area-way, is shown in the remodeled elevation in place of one of the old windows in the original.

The removal of the back porch and its replacement is indicated, although in the remodeled elevation the new back porch is not visible because of the terrace also added on that side.

The removal of the old front porch roof and its replacement by a flat roof with railing is also shown in the remodeled east elevation.

20. What are some of the changes made in the remodeled west elevation?

Answer. Two large double-hung windows on the first floor near the left-hand corner have been removed and replaced by three smaller casement windows. On the second floor the left-hand window has been removed and replaced with a smaller one.

The absence of the old back porch and steps is again noticeable in the remodeled west elevation, where the new railing and steps are visible. Also the old front porch roof and old steps have been removed and the substituted new flat roof with railing and new steps are clearly shown in these elevations.

21. What is the height between the first and second floor and between the second floor and the second-floor ceiling?

Answer. On the remodeled west elevation, at the left-hand side, there is a vertical dimension showing that the distance from first to second floor is 9'9" and that the distance from the second floor to the second-floor ceiling is 9'1".

22. How are the window sizes indicated on the remodeled elevations?

Answer. In most cases, the window sizes are indicated in each half of the double-hung windows by a fraction-like figure. These figures give the sizes of the panes of glass used in the upper and lower portions of the double-hung windows.

In some of the other windows, such as the casement windows for the kitchen, no dimensions are shown on the elevation, as these are indicated on the floor plans.

23. What type of roofing and siding is specified on the remodeled elevations?

Answer. The roofing is shown by the parallel-line symbol which means shingles. The type of shingle is not shown, so it must be looked up in the specifications, as explained in Chapter III.

Parallel-line symbols are also used on the walls of the elevation views. This means that wood sheathing of the variety commonly called siding is to be retained as on the original house.

24. What are some of the changes indicated for the remodeled first-floor plan?

Answer. The small rooms shown on the original plan at the west end of the old living room are to be eliminated. The entire south half of the old first-floor plan is to be included in the new living room. This means that the partitions around the entryway and the partition dividing the old living room and front hall are to be removed. Extending the living room across the southern part of the first floor utilizes space previously wasted by the entryway hall and the main hall at the foot of the stairway.

The old stairway leading to the second floor is to be removed as far as the first landing, and a new stairway will be constructed, parallel to the outside wall. The old seat shown in connection with the stairway in the original floor plan is to be eliminated.

The old fireplace in the dining room is to be removed, saving as much of the chimney as possible, and a new fireplace is to be built in the living room.

There is to be a hallway between the new living room and the dining room, and in this hallway a powder room is to be constructed containing a water closet and a wash basin. The hall at the foot of the stairs will begin just west of the fireplace and fireplace chimney and extend to the kitchen.

A French double door is to be constructed in the north wall of the dining room, leading out to the terrace. The bay window in the east wall of the house is to be removed. A swinging door is to be constructed between the dining room and the kitchen.

The chimney shown in the original kitchen is to be removed. Notice also the substitution of three casement windows for the old windows in the kitchen.

An entirely new arrangement of the kitchen is planned. A new sink is to be added, placed directly under the new casement windows. The pantry is to be removed. A new refrigerator and gas stove are also to be added, placed as shown in the remodeled plan.

25. With the removal of the partitions between the old living room and hallway in the original first-floor plan, what provision has been made to support the floor joists above that partition in the second floor?

Answer. From the remodeled first-floor plan we see that a Fitch girder, composed of four 2x10's with a $\frac{1}{2}$ " steel plate between them, is used within the second-floor construction as a means of supporting the second-floor joists originally supported by the partitions just mentioned.

26. What type of casement windows is shown for the kitchen?

Answer. Just outside the window symbols on the remodeled first-floor plan,

a printed specification calls for new Andersen casement windows, with the catalog number given. This can be used in purchasing windows of the correct size and description.

27. What new means of kitchen ventilation is specified?

Answer. In the remodeled first-floor plan, parallel dotted lines with a fan symbol are shown in the southwest corner of the kitchen. These dotted lines extend to the outside wall where an opening is provided. Thus, the kitchen will be ventilated automatically by an electric fan.

28. Name some of the changes specified for remodeling the second floor.

Answer. The old bathroom with its fixtures is to be removed and a larger bathroom constructed. The new bathroom takes up some of the space formerly used in bedroom 3, making that room smaller. In new bathroom 1, new fixtures have been installed throughout. A tile floor is shown by the tile symbol.

Another bathroom has been added between bedrooms 1 and 4. This bathroom replaces some of the large closet areas shown between these two rooms on the original second-floor plan. Bathroom 2 contains a shower bath, water closet, and wash basin. It also has a tile floor, as indicated by the symbol.

Closets somewhat smaller than in the original plan are provided for bedrooms 1 and 4. An entirely new closet is provided for bedroom 2, and a new and larger closet is provided for bedroom 3.

A linen closet has also been constructed in the main hallway. The chimney originally appearing in bedroom 3 has been removed.

A great many windows have been omitted or relocated as can be seen by studying the two floor plans.

29. What equipment is shown for the new closets, for instance in bedrooms 1 and 4?

Answer. Both of these closets show shelf and clothes-rod symbols. The shelf symbol indicates that a shelf is to be constructed, possibly 2' or 3' down from the ceiling, about 12" in width. Notice also that a clothes rod is to extend across each closet.

30. How is the over-all dimension for bedroom 3 determined?

Answer. The width of this bedroom is determined by the 7'8" dimension shown along the west wall. To find the exact interior width of the bedroom, half the width of the interior partition on its left side and the entire width of the exterior wall on its right side must be deducted from this 7'8" dimension.

The length of the bedroom is indicated by the 9'9" and 2'6" dimensions appearing along the north wall. From the sum of these two dimensions you must subtract the entire width of one outside wall and half the width of an interior partition to get the interior or clear length.



REMODELED KITCHEN DESIGNED FOR EFFICIENCY AND BEAUTY
Courtesy of U. S. Gypsum Company, Chicago, Ill.



KITCHEN AS IT APPEARED BEFORE REMODELING
Courtesy of U. S. Gypsum Company, Chicago, Ill.

Specifications

IN ADDITION to the drawings, or blueprints, for every well-designed remodeling job you must have a set of specifications. These may be defined as instructions to the builder, and as such they must be clear, simple, and complete. They are supplementary to, and explanations of, the blueprints from which the remodeling work is carried on. The function of specifications is to make perfectly clear every item that cannot be made clear on the blueprints.

The purpose of this chapter, then, is to explain specifications so that you will understand their importance and know how to use them to the best advantage.

FORM OF SPECIFICATIONS. Ordinarily, specifications are typewritten on 8½"x11" plain white paper and are referred to as *written specifications*. The sheets of written specifications are bound into sets, and a copy is given, with the blueprints, to each contractor for use in estimating costs (bidding) and for guidance in the actual remodeling work. This chapter gives you the typical form in which specifications are made.

OUTLINE OF SPECIFICATIONS. Customarily, specifications are written in accordance with a standard outline, which helps to prevent omissions and which makes the specifications easier to refer to and to use. We recommend the following outline:

1. Title Page. This should be the first page of the specifications and should contain the owner's name, the name of the person making the plans, a description of proposals (bids) wanted, general conditions, and special instructions.

As an example, notice the title page in the specifications in this chapter. Under "Special Instructions" there is an important



specification, instructing all contractors to visit the existing house and examine its condition to see how much expense may be saved by use of the old material. Also, there are likely to be many items of repair, such as relocating or patching, of which each contractor should be aware. In most remodeling jobs, owners should insist that bidding contractors visit the house and become familiar with existing details, as well as with the proposed changes. This practice is of equal benefit to contractors and owners.

The balance of the instruction and explanation given on the title page will help to prevent misunderstandings, by clarifying provisions relating to quality of materials, owner inspection, cleaning up after work is completed, etc.

2. Masonry Work. Under this heading the work to be done by the mason contractor should be fully explained. Special instructions as to concrete mix, mortar mix, etc., should be given in detail. In fact, special instructions should be given relative to all mason work which is not specifically explained in the blueprints.

For example, sometimes in remodeling work the interior faces of foundations are to be plastered in order to improve the appearance of old foundations. There is no symbol by which we can indicate this in blueprints; therefore it must be explained in the specifications in such a manner that the mix, thickness, troweling, and other details are covered.

3. Lathing and Plastering. Where new walls or partitions are to be erected in a remodeling job, the type of lathing must be specified. When insulation material is to be used as plaster backing, as it frequently is, this must be clearly stated. The use of metal lath and corner beads, often employed to patch between old and new plaster, must be explained. The exact areas to be lathed and plastered should also be given, in addition to the indications on the blueprints.

The type of plaster and finish coat should be described, as there is a great difference in materials used for this purpose.

Patching cracks, removal of loose plaster, and similar work should be mentioned explicitly in the specifications.

4. Carpentry Work. In most remodeling jobs, carpentry work is the largest single item. The final result, therefore, depends to a large extent on how well this work has been done.

The lumber used in remodeling should be thoroughly kiln-dried, in order to avoid excessive shrinkage and consequent cracks between old and new partitions, on the floors, or around built-in features. The specifications should state that all lumber is to be kiln-dried.

The new trim, both exterior and interior, should match the old trim, as a general rule. The specification of trim is important, because it sometimes requires special millwork which the carpenter must order and on which he must obtain special estimates.

The blueprints show all window and door removals and additions, but the specifications should describe these changes, giving the types of windows and doors to be used, their size and thickness, the hardware for them, and other details.

Most specifications name a definite sum to be spent for hardware. This is important because of the wide range in quality and cost of the items.

Insulation is generally specified as carpentry work and is so important both in cost and results, that special care should be given in making out the specifications. The exact areas requiring insulation, the kind of insulation, and the method of application should be explained in detail.

Patching of floors, trim, and other visible wood parts should be specified, wherever needed, as they contribute much to the final appearance of the house. Spacing of materials, special partition sheathing, furring, patching up old register openings, framing for new heating ducts, and like details should be explained carefully where the need for them occurs.

The person who is responsible for drawing the remodeling plans should also write the specifications and should check carefully to see that every item called for in the remodeling is completely explained, either in the blueprints or in the written specifications.

5. Linoleum. Linoleum is often used to advantage in remodeling with pleasing and modern effect, to cover old floors, walls, and ceilings.

The type of linoleum, the exact areas upon which it is to be applied, the method of application, and the use of coves (concave moldings), etc., should be explained in detail.

6. Sheet Metal Work. Sheet metal is often used in remodeling, to keep down both material and labor costs. The areas to be covered,

the gauge of metal, types of joints, and type of felt for underlaying should be explained in the specifications.

Patching around gutters, the downspouts, old and new chimney locations, and general flashing must be outlined in detail.

The sheet metal contractor often patches and lays roofing. This work, if required, should be specifically explained.

Changes in the location of downspouts often are required in remodeling. Such changes, together with types and quality of materials, need careful and detailed explanation.

7. Marble and Tile. Bathroom floors and walls, fireplace hearths, and entryways are often improved by applying tile in modern design. The quality of material, patterns, sizes of blocks, colors, types of edges, and kinds of joints must be carefully detailed. Built-in accessories and thresholds must be designated. Preparation of surfaces, application of tile, and workmanship are important.

8. Painting. No other process adds quite so much to the final appearance of a remodeling job as painting and decorating. The specifications should carefully describe all of the painting and decorating requirements. Preparation of old and new surfaces, workmanship, quality of materials, color and number of coats of paint, and quality of paper are details that should not be overlooked.

9. Glazing and Glass. The modern house is made much more livable and attractive by the use of large amounts of glass, in windows, doors, mirrors, and for decorative details. Especially good results in remodeling may be obtained through a more generous use of glass.

All areas requiring glass, kinds of glass, puttying, and other details of workmanship should be described in the specifications.

10. Plumbing. The appearance and convenience of old houses can be greatly improved by the installation of modern plumbing fixtures, including an extra bathroom or a shower, and perhaps a powder room, new kitchen sinks, and laundry equipment.

Plumbing fixtures should be listed in the specifications by manufacturer's name and catalog numbers. Sometimes the sizes, finish, and type of fixture accessories must also be described. The kind of piping, location of pipes, provision for supplying hot water, connections required, plated work, sill cocks, floor drains, and workmanship are important and require detailed specifications.

11. Heating. Proper heating, ventilation, and humidification of a house are most important to the comfort and convenience of the people who live in it. Therefore the specifications of this item should be detailed carefully.

Specifications should call for the kind, make, and size of all equipment, including ducts and grilles, firing equipment, humidifier, filters, blower, and smoke pipe. They should specify the quality of material, the workmanship, and when the installation shall begin. Further, they should require that the contractor design and make drawings for the complete system, following the requirements enumerated in the schedule.

12. Electrical Work. The installation of modern lighting fixtures, ample outlets, and proper circuits is an important improvement in most remodeling jobs.

Some of the more important specifications concern inspection, testing, location of outlets, meter and main switch, distribution, wires, switches, plug receptacles, plates, outlet boxes, bells and buzzers, fixtures and fuses, ventilating fans, quality, and workmanship. The exact locations of fixtures and outlets should be shown in the blueprints, also.

RELATIONSHIP BETWEEN BLUEPRINTS AND SPECIFICATIONS.

For remodeling jobs, the use of two sets of blueprints was recommended, one set showing the plan and elevation views of the original house and another set showing the house with the proposed additions and revisions. This latter set is called the remodeling plans.

The remodeling plans should show every possible item, such as walls, windows, doors, partitions, stairs, dimensions, rooms, halls, arched openings, location of all fixtures, materials to be used, etc. The written specifications should explain in detail everything which cannot be fully explained or shown by symbols in the blueprints.

For example, wood structural members are shown in the blueprints by symbols which indicate the material, the size, location, spacing, and installation, but such symbols cannot describe the kind of wood, nor state that it must be properly kiln-dried and free from knots and defects. This latter information must be included in the specifications.

In other words, specifications, as stated previously, are used to *supplement* the blueprints. Their purpose is to give any and all

information or directions which cannot be shown by the symbols used in plan and elevation views.

Notes are used frequently on plan and elevation views, and these must be thought of as specifications. Care should be exercised to see that these notes and the written specifications do not conflict in reference to any given item.

It may so happen that an item is described by symbols, by notes, and in the written specifications. There is no harm in this if all conflict is avoided. Usually, however, if a symbol amply describes an item, notes and written specifications are unnecessary.

Written specifications are particularly important in remodeling work because they give an opportunity to describe in detail the sometimes complicated alterations, the adaptations of existing features, and other remodeling requirements.

HOW SPECIFICATIONS ARE USED. The most important uses for specifications are as follows:

1. By estimators, to calculate the cost of materials and labor. The term *estimator* includes general contractors, sub-contractors, and manufacturers and material dealers.

From this standpoint alone specifications are very important. If they are carefully written, the estimator can price material and labor exactly, whereas, with poorly prepared or confusing specifications, the estimator is apt to *add* somewhat to the costs, in order to safeguard himself.

2. As a guide, by all the trades, in carrying out their specific parts of a remodeling job. In this case the specifications become directions to the tradesmen and explain each step of the work. Well-prepared specifications save time, reduce waste, and assure better workmanship.

3. As a means of preventing disputes between owner and general contractor, and also between the general contractor and the sub-contractors. If all necessary items are covered amply by the specifications, there can be no dispute. Contracts are made in accordance with specifications.

4. As instructions for the purchase of all types of fixtures, special millwork, and built-in furnishings.

NOTE: Specifications made by individual manufacturers, associations, or public officials may be referred to in written specifications

for remodeling. When this is done, the exact names of such published specifications, and their sponsors, must be given.

You are urged to read and study the typical written specifications for a remodeling job presented in the following pages. These specifications are to *supplement* the blueprints found in the back of the book. You are already familiar with these blueprints from your study of the Questions and Answers in Chapter II. As each part of the specifications is studied, refer to the blueprints, so that the entire remodeling work can be visualized.

SPECIFICATIONS

for

labor and material required in
the remodeling of a residence
located at 128 Laurel Street

for

Mr. JOHN J. JONES

_____, Architect

PROPOSALS

Proposals will be received for the work of the architectural trades, which includes all work required for the completion of the remodeling herein outlined and shown on the drawings, and for the mechanical trades of plumbing, heating, and electrical work.

GENERAL CONDITIONS

(NOTICE)

The following specifications shall be subject to all the conditions and requirements of the American Institute of Architects' standard form of "General Conditions of the Contract."

SPECIAL INSTRUCTIONS

SPECIAL NOTE: For the sake of brevity many of the customary stipulations as to quality in both materials and workmanship are omitted. It is understood, however, that in all cases, except as mentioned otherwise, materials and workmanship shall be first class and of standard highest grade market quality. Materials or workmanship not measuring up to these standards will be rejected.

WATER. At the beginning of remodeling operations the plumber will provide and maintain a meter and hose bibb for the use of all trades. General contractor to pay all water bills.

EXAMINATION OF EXISTING HOUSE. Each contractor shall visit the existing house to make a most careful examination of all conditions relative to his particular part of the work, including: its coordination with the work of other contractors, the use of existing materials, patching, and matching trim and other items which must be matched. He shall become thoroughly acquainted with the existing house, and with what is necessary in order to fulfill all remodeling requirements. No bids will be accepted which do not indicate a complete understanding of existing conditions and the best use of old and new materials.

SCOPE OF WORK. Refrigerators, electric fixtures, china cabinets, stoves, window shades, Venetian blinds, and other exceptions as mentioned will be purchased and installed by the owner. All other items necessary to completely remodel the existing house and make it ready for habitation shall be included in the General Contract.

TEMPORARY HEAT. Whenever heat is required during the process of remodeling, the general contractor shall provide same. He shall furnish all fuel and be responsible for operating the temporary heating equipment.

CLEANING. The dirt, rubbish, and debris from all construction operations shall be removed from the house and the site by the general contractor. All floors shall be broom-cleaned. The premises shall be kept clean during remodeling operations.

INSPECTION. The owner reserves the right to inspect the work daily and to reject all materials, matching, and other details which do not meet these specifications.

GUARANTEE. The work must be guaranteed for two years after completion of the remodeling operations. During this time any imperfections which may develop due to poor workmanship or faulty materials are to be made good without cost to the owner.

DRAWINGS. The drawings accompanying these specifications and forming a part of this contract are as follows:

Plates 1, 2, 3, 4, 5, 6, 7, and 8 are plans and elevations of existing building.

Plates 1a, 2a, 3a, 4a, 5a, 6a, 7a, and 8a are plans and elevations showing the proposed changes and corrections to the existing construction.

NOTE: The above-mentioned drawings will be found in the envelope attached to the inside of the back cover of the book.

It is intended that the drawings and specifications describe and show everything necessary to make the building ready for occupancy. Only such items specifically mentioned as not being included in this contract are to be omitted. Everything not shown on the drawings but shown in the specifications, or vice-versa, shall be furnished as if shown in both drawings and specifications.

LUMBER. All lumber required for studs and joists shall be thoroughly kiln-dried to avoid as much shrinkage as possible. All such lumber to be inspected by owner before being used. All lumber to be first class as hereinafter described.

INDEMNITY AND INSURANCE. The owner will carry fire insurance for the building, protecting both himself and the contractor. The contractor shall carry all other forms of insurance required by law. He shall indemnify and save

harmless the owner against all claims, actions, or judgments brought or recovered against the owner for, or on account of, injuries or damages to persons or property sustained by any party whomsoever by reason of any act of his employees, his subcontractors, or other employees in the construction of the work. The contractor shall carry Workmen's Compensation and Liability Insurance covering the period of construction. Upon completion of the building and before final payment is made, the contractor shall sign a Release of Liens covering himself and all his subcontractors.

STATE AND LOCAL LAWS. The general contractor shall see that all state and local laws relative to building are observed. He shall obtain and pay for all necessary permits.

BREAKING DOWN BID. Each contractor shall present his bid in such a manner that all parts of it can be checked.

MASONRY

STEEL AND IRON WORK. In addition to the usual masonry work all structural steel and all miscellaneous and ornamental steel, iron, and metal work shall be furnished and set by mason contractor.

Dampers for fireplaces, Colonial or Covert, back-hinged, concealed control, of sizes required.

All ironwork of every description shall be delivered shop-painted one coat. All metal work to be thoroughly insulated with paint against corrosion before installation, and after where possible.

Steel sash to be Vento, Fenestra, Truscon, or Hope manufacture, and shall be completely equipped with standard stock hardware as catalogued. All basement windows to be equipped with bronze-wire screens.

STEEL SASH. Cut and build in the two new steel sash specified for the playroom. Point up neatly around the sash, when they are placed, to form a new cement sill.

AREAWAYS. Provide stock galvanized corrugated areaways for new windows in the playroom. Areaways to have sand bottoms. Sand to be at least 12 inches deep.

FURNACE-ROOM WINDOW. Brick up the northeast window opening in the furnace room, as specified on plans.

CHIMNEYS. Rebuild the chimney, forming an open fireplace in the living room, as shown on the drawings. The existing furnace flue may be re-used. All brick work in connection with this chimney shall be common brick laid on cement and lime mortar. Flues shall be lined with terra cotta flue lining of the sizes shown on the drawings. The fireplaces in the playroom and living room shall both be lined with firebrick and set in fire clay. The living room fireplace shall be provided with ash dump, as indicated.

Remove entirely the brick chimney shown at the rear wall in the existing house.

REAR TERRACE. Build the rear terrace as shown on the drawings, using 14" rubble-stone foundation to match the existing. Provide a 4" concrete slab, reinforced with road mesh, to be laid over 6" of cinders. Rear walls to be filled to proper level. Provide concrete steps to receive stone. The floor of this terrace and the treads and risers of the steps shall be formed of variegated colored flagstone 1" to 1½" thick laid in the pattern indicated. All joints shall be uniform and shall be neatly pointed up. All surplus cement to be well cleaned from the surface of the stone leaving a neat job at completion.

ENTRANCE STEPS AND PORCH. After the existing rear porch is removed, build a concrete platform with cement steps, as indicated on the drawings. Remove the existing front porch steps, including the cement work and steps to the street. Point up exposed masonry as required on this porch.

BASEMENT FLOOR. Remove all portions of old existing concrete floor. Excavate to required lines. Place a leveling pad of 3" to 4" of cinders and a new concrete floor 4" thick, troweled smooth and sloped to drain in furnace room and laundry. In the playroom set wood sleepers 16" O.C., allowing 1" air space between top of sleepers and concrete. Other contractor will build 1x4-inch fir flooring over the sleepers. Linoleum to go over wood floor.

Place a new concrete footing 12"x24"x24" under the girder support in laundry.

Surface of old foundation in laundry and furnace room shall have a coat of cement plaster to fill all holes and uneven spots. New surface shall be troweled smooth.

All concrete to be mixed in the proportion of 1:2:4.

SIDEWALK. Install a small section of sidewalk from main porch steps to the existing driveway consisting of 4" of concrete on 8" of cinders, troweled smooth.

DRIVEWAY. Patch existing driveway as required to make first-class appearance.

IRONWORK. Install a new girder in basement where indicated. Provide a new 4" pipe column with base and cap, replacing the locust wood post under the girder in the laundry. Provide a ½" plate for the new Fritch girder over the living room with holes staggered 2' O.C. for bolting of wood members. This plate shall be ¼" less than the depth of the joist. Other contractor will assemble Fritch girder and install. Provide an additional 3"x3¼" angle for each fireplace. Provide a stock ash dump for living-room fireplace. Provide a cleanout door for ash dump.

The lower run of the main stairs, which is new, shall be provided with a wrought-iron handrail consisting of ½"

square and twisted balusters with stock cast-iron shoe member 1" channel top. Arrange to receive wood rail. This endrail shall be provided with all easements, etc. Provide 1" square twisted newel at start. Rail shall be oil treated and hammered.

TERRACE RAIL. Provide a simple railing around the rear terrace and service entrance in the design shown on the drawings with $\frac{1}{2}$ " balusters, $\frac{3}{4}$ " corner posts, 1" channel base member, and stock molded top rail. This railing shall be securely fastened and leaded into place.

LATHING AND PLASTERING

Lath all new work in basement, first, second, and third floors with rocklath. In playroom the rocklath over foundation shall be applied over furring installed by carpenter. Where minor partition changes are made, provide metal lath strips. The entire playroom walls and ceiling, together with the partition around the basement stairs and the wall at foot of the stairs, shall be lathed with rocklath, as hereinbefore mentioned. All new plaster work shall be two-coat work of standard brand of ready-mixed plaster white coated with plaster of Paris and lime putty. For all new plaster work provide corner beads.

PATCHING EXISTING PLASTER. Cracks in the existing plaster shall be cut out to a width of $\frac{1}{4}$ " with the sides beveled inwardly, then replastered with patching plaster, and shel-lacked. All loose plaster to be removed and the holes replastered.

NOTE: The contractor shall be required to return to the job after completion of work of the other trades, and shall repaint and patch all items of his work that have been damaged thereby.

All metal lath shall be supported and secured in accordance with manufacturer's directions. Similarly, all plastering materials shall be handled according to the recommendations of manufacturers.

GUARANTEE. All plastering work shall be guaranteed for a period of 18 months against such cracking, popping, or other defects as may be directly due to materials and workmanship in lathing and plastering.

CARPENTRY

FRONT PORCH CHANGE. The existing concrete steps are to be removed, as hereinbefore specified, and new steps placed at the end of the front porch. These steps shall be built of $1\frac{1}{8}$ " pine treads with $\frac{7}{8}$ " risers. Provide 4 rough horses set on concrete at the base and nailed to the existing porch construction at the top. Remove the section of rail at the

end of porch and install a new section of rail at the front, this rail to match the existing. Any removed portion of rail in good condition and of required length may be re-used. The gable roof on the porch is to be removed to the level shown on the drawings and a new roof placed consisting of 2x6 rafters 16" O.C. covered with $\frac{7}{8}$ " T. & G.Y.P. sheathing left ready to receive tin. Provide a wood rail around this porch deck in the design indicated, the rail to be of white pine. The top of this rail shall be beveled to drain water. Lattice work shall be repaired and put in good shape around base of porch, placing new lattice work where required.

REAR PORCH. Remove the existing rear porch entirely, patching the walls of the building where they are damaged or disturbed. This same patching shall be done on the front porch where the gable is removed.

WINDOW CHANGES. Remove all windows indicated to be removed, cutting in windows in new locations where shown, using existing windows where they are in good condition, but installing new windows where indicated on the drawings. Where new windows are installed they shall be made to match the existing with the exception of the new window in the kitchen which shall be a stock out-swing, weather-stripped casement window of Andersen or equally approved make. Provide a trim on the exterior of this window to match the existing. Provide double studs and lintels for all openings changed. After all windows have been corrected, go over all of the exterior work, replacing and re-nailing as required and leaving all in first-class condition ready for painting.

INTERIOR CHANGES. Where the partition between the present living room and hall is removed, place a new Flitch type girder framed flush bottom and top with the existing joists. Provide a 2x3 nailer at each side for the support of the joist. Proper shoring shall be provided while this change is being made.

Remove all partitions indicated to be removed and build all new partitions as shown. Existing studding in good condition may be re-used. Studding for new partitions to be 16" O.C. Double studs to be used at all doors.

Stair Change. The main stairs from the first floor to the landing shall be changed. Build a new run of stairs as indicated on the drawings. These stairs shall be $1\frac{1}{2}$ " oak treads with white pine risers and white pine stringers. The stringers shall be open on one side with tread nosing and scotia returning. The endrail will be a section of wrought-iron handrail. Provide all framing necessary to close up the old stair well opening. Rebuild basement stairs according to remodeled plans.

Doors. Provide a new entrance door to be set in the existing door jamb, which shall be moved to the west. This

door shall be $1\frac{3}{4}$ " thick panel stock design in white pine. Provide new French doors from the dining room to the terrace $1\frac{3}{4}$ " thick stock white pine with wood glass stops $1\frac{1}{2}$ " solid rabbitted white pine jambs with trim or exterior to match existing.

Provide new doors for the third-floor bedroom, the powder room, and closets as required. All of these doors shall be provided with $\frac{7}{8}$ " white pine jambs with stops supplied and shall be $1\frac{3}{8}$ " thick, doors made to match existing.

Floors. Cut out and patch all bad places in first and second floors. Machine sand and make ready for linoleum or carpeting.

In the third-floor bedroom, bathroom, closet, and hall lay 1"x4" fir over pine subfloor. Machine sand and make ready for linoleum. In the playroom lay 1"x4" fir over sleepers. Machine sand and make ready for linoleum.

Trim third floor and playroom to match trim in other areas.

In bathrooms 1 and 2 prepare drop flooring for tile floors. Powder room floor to be linoleum.

Floor surface in playroom to be at same level as concrete floor in laundry.

Hardware. Allow the sum of \$150 for the purchase of new hardware. This shall include hinges for new doors, complete lock sets for all new doors, new knobs and escutcheons for existing doors, and new sash fasts and lifts for all windows. All new hardware is to be applied by the contractor under this contract. Hardware will be selected by the owner. Any variation from the allowance to be credited or billed as extra.

Miscellaneous. The roof shall be neatly patched and reformed where the chimney changes make this necessary, leaving it ready for patching by the slater.

The small section of rail for the new section of stairs will be wrought iron. The contractor shall provide a $2\frac{1}{2}$ " stock mould birch endrail provided with all easements, etc., necessary and securely fastened to the top member of the rail.

All doors and windows shall be provided with trims to match the existing. Old trim in good condition may be re-used. All base shall be patched and repaired providing new base to match the existing where necessary.

All closets shall be provided with a self-adjustable chromium-plated closet pole and four hooks.

Where the old heating plant is removed patch the floors and walls at the old openings, leaving same ready to receive finished floor or plaster.

Allow the sum of \$400 for the furnishing of kitchen cabinets and a kitchen sink, bid to include installation of

these furnishings and allowance to cover the purchase of equipment selected by the owner. The ceiling shall be furred down to the head of the cabinets.

The existing mantel in the dining room, which is to be removed, may be re-used in the playroom. Provide a new mantel made of white pine with birch shelf for the living-room fireplace. Facing and hearths are specified on the drawings.

In the playroom install 1"x2" furring strips on all three foundation walls. Prepare ceiling for lathing.

All trim inside and out shall be matched where alterations or patching are necessary.

Put D.&M. on furnace and laundry side of basement partition. Put plaster board on furnace room and laundry ceilings.

Consult with heating and plumbing contractors concerning framing, cutting structural members, and providing necessary openings.

Examine entire house and if any further work is thought advisable, make recommendations to owner before submitting bid.

Bathrooms. In all three bathrooms and in the powder room this contractor is to furnish and install medicine cabinets as follows.

Powder room - No. 822 Taconic insert medicine cabinet. W/18"x28" Venetian mirror door for 15½"x23¼"x3½" rough wall opening.

Bathroom 1 - No. 1000 Berkshire insert medicine cabinet W/18"x28" Venetian mirror door for 15½"x23¼"x3½" rough wall opening.

Bathroom 2 - Same as bathroom 1.

Bathroom 3 - Same as bathroom 1.

Install soap holder, paper holder, towel rail, and robe hook in bathroom No. 3. Owner to supply.

INSULATION. This contractor to furnish and install all insulation. He shall work at the convenience of other trades. Provisions for ventilation shall be provided for as specified by manufacturer.

Eagle insulating wool shall be used full length in partitions around the stair well, hall, bedroom, bathroom, and closet on third floor.

Apply moisture barriers as per manufacturer's specifications in all cases where insulation is used.

The same insulation shall be used in the ceilings and roof over all third-floor rooms and in dormer walls. Likewise the same insulation shall be used in the second-floor ceilings between knee walls and eaves and in all side walls.

Insulation between joists to be 4½" deep. In walls and roof the insulation is to be packed according to manufacturer's specifications.

LINOLEUM

All linoleum to be Congoleum-Nairn. The playroom, hall at foot of basement stairs, kitchen, hall from kitchen to dining room, powder room, all bedrooms on second and third floors, all closets, second- and third-floor halls, and bathroom 3 to have linoleum floors which will be selected by owner. Under all floor linoleum use $\frac{1}{8}$ " thick $1\frac{1}{2}$ pound dead-ening felt, cemented. Linoleum to be cemented to felt.

The walls in the kitchen and bathroom 3 shall also be covered with linoleum selected by owner. All external corners to be rounded. All junctions between horizontal and vertical surfaces shall be coved.

In bedrooms and playroom the linoleum is to extend well under quarter rounds.

Felt and linoleum shall be properly rolled in place and linoleum shall be weighted with sand bags. Intersections of linoleum and other floor materials except in bathrooms 1 and 2 shall be made with 16-gauge, 1" wide brass threshold strip.

SHEET METAL

Where the rear chimney is entirely removed and where the front chimney is altered, this contractor shall patch the slate work and shall reflash and cap flash around the new chimney. This flashing shall be of copper. All gutters and conductors of the house shall be gone over and put in good condition. Replace any broken slate in the roof. The front porch roof, which is new, shall be covered with 30-pound slaters' felt over which apply 40-pound tin painted both sides. All joints shall be locked and soldered. Provide flashing member at the posts supporting the wood rail.

TILE

All work according to "Basic Specifications for Tile Work," 1921 edition, issued by Associated Tile Manufacturers, insofar as possible.

BATHROOMS 1 AND 2. Floor--Selected $4\frac{1}{4}$ "x $4\frac{1}{4}$ " matt-glazed vitreous floor tile of colors to be selected by owner. Standard joints. Thresholds $\frac{7}{8}$ " Gray Tennessee Marble, home-finish rounded edges, full width of jambs, extending to back of jambs.

Walls--Selected $4\frac{1}{4}$ "x $4\frac{1}{4}$ " bright white glazed wall tiles. Standard joints. Internal corners square. External angles A-1632. In bathroom 1, wall tile to be 6' high except around tub where it is to be 8'. In bathroom 2, tile to be 6' high all around. The showers in bathrooms 2 and 3 have tile floors and full height walls using same kind of tile as for bathroom walls.

The tile contractor shall place his own back of metal lath and cement plaster for his tile work. He shall also

provide a cement foundation for the floors. Cut floors will be provided by the carpenter. The tile work shall be laid without lipping, should be grouted with white waterproof cement and shall be of first-class workmanship throughout.

Wall caps same as tile A-4260, with external angles AC-4200, up corners AM-4220 and down corners AN-4200. Black insert strip $\frac{3}{4}$ " wide one tile away from cap. Base--A-3310 of same tile as floor, outside angle AC-3310.

Built-In Accessories. In bathroom 2 install 1 - 6"x4 $\frac{1}{4}$ " self-draining recess combination soap and grip. In bathrooms 1 and 3 install:

1 - 6"x4 $\frac{1}{4}$ " recess soap holder.

1 - 6"x6" recess toilet-paper holder, plain roller, no hood.

1 - 18" white glass shelf bolted to tile dowel back of brackets.

1 - 18" } square Pyralin finish towel bars with tile
1 - 24" }

dowel back posts.

The existing mantel from the dining room shall be used in the playroom. This contractor shall provide a red-quarry tile facing and hearth for this mantel. The living room mantel shall be provided with Italian Crema $\frac{7}{8}$ " thick marble facing and front hearth. All exposed surfaces to be polished. The hearth may be in three pieces with border. Facing shall be figured 5" wide with a 10" member at the head. Hearth will be 16" wide by the length of the mantel.

PAINTING

All colors to be selected by owner.

EXTERIOR. Remove all loose or scaled paint with wire brushes. Putty all cracks and nail holes, seal all knots with shellac, and paint all exterior woodwork with two coats of lead and oil paint on old woodwork; three coats on new.

All exterior ironwork shall be cleaned and painted one coat of red lead and two coats of lead and oil paint. All sheet metal work shall be cleaned, touched up, and painted one additional coat of lead and oil paint. The tin roof on the front porch shall have one shop coat of red lead. Contractor shall paint this roof one additional coat of lead and oil paint. All painting shall be a standard brand ready-mixed paint, or shall be Dutch Boy or Eagle-Picher white lead and pure boiled linseed oil neatly applied and free from brush marks.

INTERIOR. All old woodwork, except floors, shall be cleaned with ammonia. Cracks and nail holes to be puttied and given two coats of undercoater and one coat of enamel. Woodwork in powder room and kitchen shall be given an extra coat of enamel.

All new woodwork including third floor and playroom shall receive an additional priming coat.

The top portions of walls in bathrooms 1 and 2, the ceilings in all bathrooms and in the kitchen shall be painted one coat primer, one coat undercoating, and one coat enamel gloss.

All closets shall be painted one coat primer and one coat flowing flat.

The D.&M. in the basement shall be painted one coat primer and one coat flat.

The basement stairs shall be painted one coat flat.

All existing paper to be removed. Patching of plaster as hereinbefore specified.

The living room, dining room, first-, second-, and third-floor halls, all bedrooms, first- and second-floor stair wells, playroom, hall at foot of basement stairs, and the powder room shall have walls and ceilings sized and then papered following owner's selections.

First- and second-floor stairs to be painted according to owner's specifications.

DOORS. All doors except outside kitchen and side doors to be stained, shellacked, and varnished. The inside kitchen and bathroom doors are to be stained on one side and enameled on the other. Front door to have three coats spar varnish on exterior side.

MISCELLANEOUS. It is intended that the painting and finishing specifications shall cover all work throughout the building that usually is painted or finished to make a complete job, whether or not every item is herein mentioned, and this contractor is to provide same.

PREPARATION AND WORKMANSHIP. No spots to be left on glass, hardware, or other finish work. All hardware except butts to be placed and then removed before painter's finish is applied.

All checks and nail holes shall be puttied flush with surface and sandpapered smooth. All surfaces shall be perfectly smooth, clean, dry, and free from sandpaper scratches before receiving painter's finish.

All knots, sap, and pitch streaks shall be primed with aluminum paint or shellacked, in stained work, before painter's finish. No exterior painting to be done in rainy or freezing weather.

For interior work all items shall be sanded after first coat and before last coat. Upper and lower edges of all wood doors and sash and side edges of all doors shall be finished the same as other portions of these items. Side edges of wood sash shall be oiled.

MATERIALS. Varnishes - Glidden's, Pratt and Lambert's, or Berry Brothers' as may be specified.

SPECIFICATIONS

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Enamels - Pratt and Lambert's "Vitrolite" or Glidden's "Ripolin."

Stains - E. I. du Pont de Nemours Company, Berry Brothers', or Johnson's spirit, or oil stains as required.

Shellacs shall be pure white shellacs.

GLAZING AND GLASS

DESCRIPTION. Exterior French doors shall be glazed with polished American plain plate glass, 3/16" thick.

All other glass required shall be Libbey-Owens-Ford paper packed sheet glass D.S.A., except in cabinets where it shall be S.S.A.

All translucent glass in bathrooms shall be hammered glass.

SETTING. Prime all wood sash in oil before glazing and cut all glass with smooth, straight edges.

All putty shall be of approved quality that will harden in two weeks' time and remain free from checks. Putty for use in metal windows shall be an approved special putty, used as recommended by window manufacturer.

Glass in all doors and mirrors, and elsewhere as may be indicated, shall be set in loose glazing beads and wood stops. Glazier shall secure stops in place.

Items set in beads or stops shall be back-puttied and stops bedded in putty. All remaining glass shall be bedded in putty, tacked with glazing points in wood sash, secured with clips in metal sash and neatly puttied and back-puttied.

PLUMBING

All three bathrooms and the powder room will have new fixtures. All existing fixtures are to be removed from the property. Provide soil and waste connections to all fixtures, soil pipe to be cast-iron pipe with caulked and leaded joints. Waste pipe below floors to be galvanized wrought-iron pipe. Vent pipe may be of steel. All fixtures shall be vented. Existing waste pipe in good condition may be re-used. This contractor shall do all excavations and connections below the floor necessary for the installation of his new piping. Before plastering, a test shall be made insuring freedom from leaks.

All water piping throughout shall be new. Sill cock connections to be provided with a stop and drip in basement. Provide gate valves on all risers. Use streamline type K copper.

Hot water shall be provided by a coil in the heating plant connected to a 60-gallon storage tank in parallel with a triple coil, asbestos lined, gas-fired tank heater pro-

vided with Robertshaw thermostatic valve. Connect heater to flue.

Furnish and set the following fixtures which have been selected from the Standard Manufacturing Company line. Fixtures of another make and of equal quality may be substituted upon written approval of the owner.

POWDER ROOM.

Lavatory: 1 - "Standard" F-114-S, Size 26"x14 $\frac{3}{4}$ " Marlton white vitreous china lavatory; supported on wall hangers; fitted w/ re-nu combination supply and pop-up drain fitting, B-804 - $\frac{3}{8}$ " supplies w/ stops, B-906 - 1 $\frac{1}{4}$ " "P" trap. Exposed Brass Chromard Finish.

Water Closet: 1 - "Standard" F-2045 Compact white vitreous china two-piece coupled closet; having syphon-vortex bowl, tank w/ fittings for exposed supply, supply to floor or wall w/ stop, Church C-214 seat and cover, closet screws and china bolt covers. Exposed Brass Chromard Finish.

BATHROOM 1.

Bathtub: 1 - "Standard" P-2215 or 2217, size 5' MASTER PEMBROKE cast-iron white acid resisting enameled recess bath; fitted w/D-73 re-nu transfer valve bath and shower fittings, B-274 Victor shower head, B-448 - 1 $\frac{1}{2}$ " connected waste and overflow, B-293 curtain rod w/ pins, B-298 hold - back hook and chain. Less Curtain. Exposed Brass Chromard Finish.

Lavatory: 1 - "Standard" F-125-MT, size 24"x20" Comrade white vitreous china lavatory; supported on wall hanger and No. 48 metal legs having projecting side flange towel bars; fitted w/ B-702-L re-nu supply and pop-up drain fitting, B-792 - $\frac{3}{8}$ " supplies w/ stops, B-960 - 1 $\frac{1}{4}$ " "p" trap. Exposed Brass Chromard Finish.

Water Closet: 1 - F-2045 Compact closet, complete as specified for powder room.

BATHROOM 2.

Shower: 1 - "Standard" B-172 built-in re-nu compression valve shower w/ union coupling for $\frac{1}{2}$ " I.P., transfer valve, bent arm, escutcheon, B-274 Victor shower head and foot-test nozzle. Exposed Brass Chromard Finish.

1 - #2062-A JOSAM combined drain and trap w/ chromard strainer.

Lead Pan. The plumbing contractor shall furnish and install under entire floor of shower stall a 4-pound sheet lead pan which shall extend up in construction to a height of 12" at back and two sides and at curb in front. Joints shall be soldered and made watertight. Lead pan shall be securely connected to drain.

Lavatory: 1 - F-125-MT COMRADE lavatory; complete as specified for bathroom 1.

Water Closet: 1 - F-2045 COMPACT closet, complete as specified for powder room.

BATHROOM 3.

Shower. Same as for bathroom 2.

Lead Pan. Same as for bathroom 2.

Lavatory. Same as for bathroom 2.

Water Closet. Same as for bathroom 2.

KITCHEN SINK. This is to be supplied by owner and installed by plumber.

MISCELLANEOUS. All plumbing according to state and local plumbing codes and all workmanship and materials to be of the best grade and guaranteed against any and all defects in either materials or workmanship or both for one year after final acceptance of the work by the owner.

HEATING SYSTEM

The existing gravity hot-air heating system is to be entirely removed and disposed of. This includes the furnace, smoke pipe, leaders, cold-air returns, hot- and cold-air registers, chain regulator, and wall stacks.

NEW SYSTEM. The new system is to be a mechanical warm-air heating system, gas fired, and of a type manufactured by The Trane Company. The work shall consist of installing all register faces, register boxes, duct work, filters, blower, humidifier, heater, gas burner, and all motors, accessories, and controls to make the system entirely safe and automatic. Each room is to have a warm-air supply register and a cold-air return register except the kitchen and bathrooms where only hot-air registers are required. The playroom is to have hot- and cold-air registers also.

SCHEDULE. Heating contractor to compute heat losses for the entire building, design the system, prepare drawings which show the whole system, locations of registers, etc., and recommend exact size and capacity of heating unit, all of which shall be presented for owner's approval along with the bid. The manufacturers of register faces and of all other major parts shall also be mentioned.

MATERIALS. All materials shall be new and the best of their respective kinds and shall be approved by owner before being installed. Any required materials or apparatus not specified shall be furnished and installed as part of contract.

The contractor shall, without extra charge to the owner, readjust his piping where required to allow other contractors to install their work.

CUTTING OF STRUCTURAL MEMBERS. In general all cutting is to be done by the carpenter after consultation with this contractor. Cutting which might impair the strength of important structural members to be done only after consulta-

tion with the carpentry contractor and then only if suitable means can be found to supply required strength in another manner.

START OF WORK. Work to be started promptly as required by progress of other trades and to be completed so as not to interfere with the final completion of their work.

MISCELLANEOUS. The entire air circulation portion of the heating system shall be tight enough positively to prevent infiltration of dust, odors, or gases from the basement or the construction. All warm-air supply registers to be made tight with felt or other approved material to prevent air or dust streaks on walls; and all pipes and ducts to be tight, covering joints with paper where required. All warm-air pipes to be equipped with close-fitting volume dampers placed in accessible location. All cold-air return registers in bedrooms positively to be of dampered type similar to warm-air registers.

The returning air is to pass through the filters, the blower, the humidifier, and the header unit. Blower, humidifier, and gas burner to be controlled automatically.

With room temperature 70°F., outside temperature of 0°F., and outside relative humidity 25 per cent, the relative humidity in the house shall be around 40 per cent. All rooms of the house shall be heated to 70°F., with outside temperature of 0°.

ELECTRICAL

A complete new system of electric wiring is necessary, including the installation of a new thirty-ampere three-wire service, leaving connections for the light company to provide a meter on the exterior of the building and to provide a conduit to a panel board located in the basement. Provide a thirty-ampere cutout switch and a safety-type block fuse panel board. Panel board shall have two spare circuits over and above those required for the building. Provide outlets—No. 12 BX to the main outlet, No. 14 BX to the branch circuits—to all openings shown on the drawings. All switches shall be Connecticut, Bryant, or H&H, silent-type toggle switches with bakelite plates in the color selected. All receptacles shall be of a make similar to the switches, double-plug outlets with bakelite plates. Install three-way wiring where indicated on the drawings. All fixture outlets shall be provided with fixture studs. Provide iron boxes for all outlets. No lighting fixtures are included in this bid. Install a new line to the garage connecting to the existing garage wiring. This line may be overhead.

Attach new front entrance and kitchen doorbells to a bell ringing transformer. Provide simple brass pushes and two-tone bells. Provide a $\frac{1}{2}$ " conduit from bedroom 1 to the

basement for future telephone extension. Furnish and install a Westwind or equal 10" kitchen ventilating fan complete with louvres and inside door.

This contractor shall provide the turnover certificate of inspection from the National Board of Fire Underwriters covering all of his work.

MISCELLANEOUS

CARPETING. The living room, dining room, and hall between them shall be carpeted following owner's selection. The second- and third-floor stairs shall be carpeted, also following owner's selection.

INSULATION. See Carpentry section of these specifications.

WEATHER STRIPPING. Provide new interlocking zinc weather stripping for all windows. Provide a $4\frac{1}{4}$ " interlocking brass sill for main entrances and doors from dining room to terrace. Provide a $1\frac{1}{2}$ " interlocking brass sill for kitchen door. Spring bronze for sides and heads of all doors.



A MODIFICATION OF THE CAPE COD STYLE, WITH EXTERIOR WALLS PARTLY IN STONEWORK AND PARTLY IN BRICK
Courtesy of Curtis Companies, Incorporated, Manufacturers of Curtis Woodwork, Clinton, Iowa

CHAPTER IV

Fundamentals of Remodeling

BEFORE the actual *drawing* of plans for remodeling a house begins, a great deal of preliminary thought must be given to the following fundamentals:

What constitutes remodeling?

Is remodeling worth while?

Remodeling requirements

Financial considerations

These fundamentals are equally important whether you intend to plan the remodeling of your own home or are going to do a remodeling job for someone else.

The purpose of this chapter is to explain the various items involved in these fundamentals, so that you may consider each of them in relation to the proposed remodeling. These items are presented in outline form, to serve as a checklist in the study of this book, as well as a guide to the preliminary thinking which needs to be done in connection with any remodeling job.

WHAT CONSTITUTES REMODELING?

The term *remodeling* has been loosely used to indicate almost any work done to an existing house for the purpose of improving it in one way or another. This use of the term has often led to misunderstandings, and therefore a much more definite classification of improvement work is recommended.

Remodeling can be divided into four classifications, each of which should be called by its proper name. The recommended divisions are as follows:

Extensive alterations—exterior and interior (complete remodeling)



Extensive alterations, interior—little, exterior (partial remodeling)

Modernizing equipment, decorating, etc. (modernizing)

Putting a house in good repair (repairing)

I. EXTENSIVE ALTERATIONS—EXTERIOR AND INTERIOR. This classification includes alterations and changes which can be referred to as complete remodeling, since any house so treated is really *re-modeled* from its original state to one entirely different. In other words, a remodeled house is one which has been made *completely*



Fig. 73A. Exterior View of Old House Before Remodeling

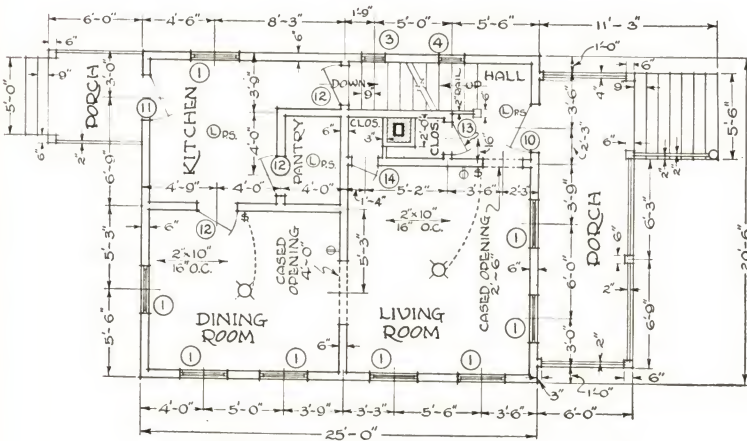
Courtesy of Walter B. Kirby, Architect

different from the old or original house from which it was built. The terms, *remodel* and *remodeled*, therefore apply only in cases where changes have been so complete that the old house has lost its original appearance and has taken on an entirely different appearance, both inside and outside.

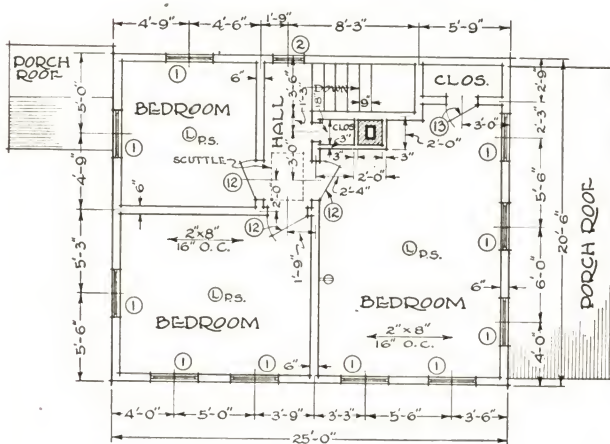
Fig. 73A shows an exterior view of an old house which, although of sound construction, is poorly planned and is too small to fit the needs of a growing family. Also it is far from attractive in appearance. Fig. 73B illustrates the floor plans for the house in 73A, while Fig. 74B, Plates 1 and 2, shows the floor plans for the remodeled house illustrated in Fig. 74A.

WINDOW SCHEDULE	
①	DOUBLE HUNG 3'-0" x 5'-2" 2 LTS.
②	DOUBLE HUNG 2'-0" x 5'-2" 2 LTS.
③	DOUBLE HUNG 1'-6" x 3'-10" 2 LTS.
④	DOUBLE HUNG 1'-8" x 3'-10" 2 LTS.
○	

DOOR SCHEDULE	
⑩	3'-0" x 7'-0"
⑪	2'-10" x 6'-8"
⑫	2'-6" x 6'-8"
⑬	2'-0" x 6'-8"
⑭	1'-8" x 6'-8"
○	



FIRST FLOOR PLAN



SECOND FLOOR PLAN



Fig. 73B. First- and Second-Floor Plans for House Shown in Fig. 73A

Courtesy of Walter B. Kirby, Architect

Fig. 74A shows the transformation that has been accomplished by remodeling the old house illustrated in 73A.

It is evident from a study of these *before* and *after* pictures and drawings that a great many important changes were made in the old house to give it a modern and pleasing exterior, more rooms (shaped in modern fashion), closet space, correct lighting and ventilation, proper orientation, etc. These alterations have completely changed the appearance of the house, both inside and out, and therefore constitute a complete remodeling job.



Fig. 74A. Exterior View of House Shown in Fig. 73A, After Remodeling
Courtesy of Walter B. Kirby, Architect

The following comprises a checklist of the exterior items ordinarily changed, built, or rebuilt in remodeling.

A. OUTLINE FOR REMODELING EXTERIORS (ELEVATIONS). Change old style of house to a different or modern type of architecture.

1. Decide on new type of architecture to be planned. (Procedure explained in Chapter V.)
2. Remove old porches like those in Fig. 73A.
3. Take off old ornamentation or "gingerbread."
4. Change roof pitch.
5. Add dormers.
6. Add new wings for additional rooms and garages.
7. Change from bungalow to story and a half.
8. Change from story and a half to full two stories.

9. Correct the impression of too much height.
10. Add shutters.
11. Change window locations to conform to new type of architecture.
12. Reduce overhang of eaves.
13. Add new roofing material.
14. Add new chimney.
15. Change positions of downspouts.
16. Add new entrance door.
17. Redesign railings around entrances and porches.
18. Take off old trim and redesign in keeping with the style of architecture selected.
19. Remove old windows and replace with those of modern type and size.
20. Remove old window glass and replace with divided lights.
21. Add weatherstripping for doors and windows.
22. Add garage.
23. Change siding material.
24. Repaint.
25. Add new concrete or flagstone steps and walks.
26. Add terraces.
27. Orientate to lot.

The items in the foregoing outline, as previously indicated, are those ordinarily considered in planning the remodeling of exteriors of houses. They are typical, but do not include every possible change, nor would all of these changes be made in any one dwelling. Their purpose is to illustrate, in a general way, what exterior remodeling is, and to serve as a guide in the preliminary consideration of any remodeling job.

EXAMPLE. Starting with the old house in Fig. 73A, for example, our preliminary thinking would follow the outline for exterior remodeling, somewhat like this:

Item 1. This item calls attention to the fact that the first thought, in any remodeling job, must be consideration of the type of architecture best suited to the various requirements, the taste of the owner, etc. This is a question which must be settled before any of the plans can be started. (See Chapter V.)

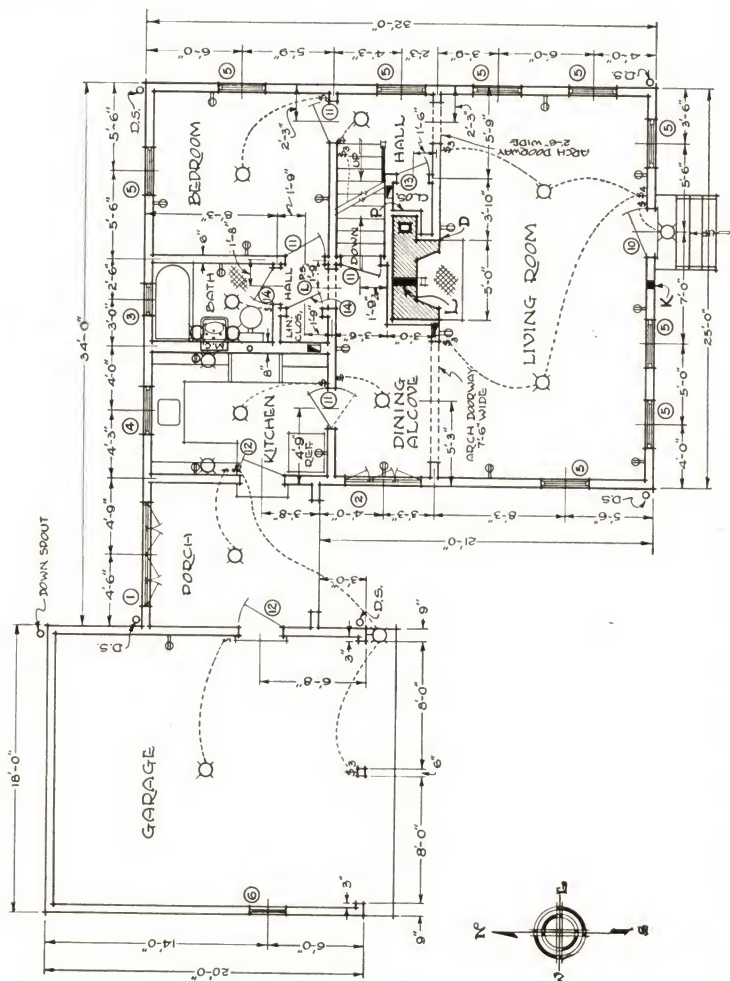
Item 2. Old-style porches are not ordinarily used in modern houses. Fig. 73A shows such a porch, so we must give some preliminary thought to taking it off and making provision for another type of entrance detail.

Item 3. Old-style ornamentation does not fit in with modern ideas of simplicity in exterior design. Therefore its removal must be carefully considered.

Item 4. Roof pitches must be changed in instances where the type of architecture selected is radically different. Our preliminary thinking on this point, therefore, must be based on the roof pitches consistent with the various types of architecture.

WINDOW SCHEDULE	
①	CASEMENT 6'-6" x 5'-4"
②	CASEMENT 4'-10" x 4'-3½"
③	DOUBLE HUNG 2'-0" x 3'-6" 2 LIGHTS
④	DOUBLE HUNG 3'-0" x 4'-2" 12 LIGHTS
⑤	DOUBLE HUNG 3'-0" x 5'-2" 12 LIGHTS
⑥	DOUBLE HUNG 2'-4" x 5'-2" 12 LIGHTS
⑦	

DOOR SCHEDULE	
⑩	3'-0" x 7'-0"
⑪	2'-6" x 6'-8"
⑫	2'-10" x 6'-8"
⑬	2'-0" x 6'-8"
⑭	2'-4" x 6'-8"
⑮	



FIRST FLOOR PLAN

Fig. 74B, Plate 1. First-Floor Plan of House Shown in Fig. 73A, After Remodeling
 Courtesy of Walter B. Kirtby, Architect

Item 5. Fig. 73A is already a full two stories, so this item does not enter into consideration unless the lowering of the roof is contemplated, in which case the second-floor windows would require dormers. Or, if one or more third-floor bedrooms were contemplated, dormers would be required for third-floor windows.

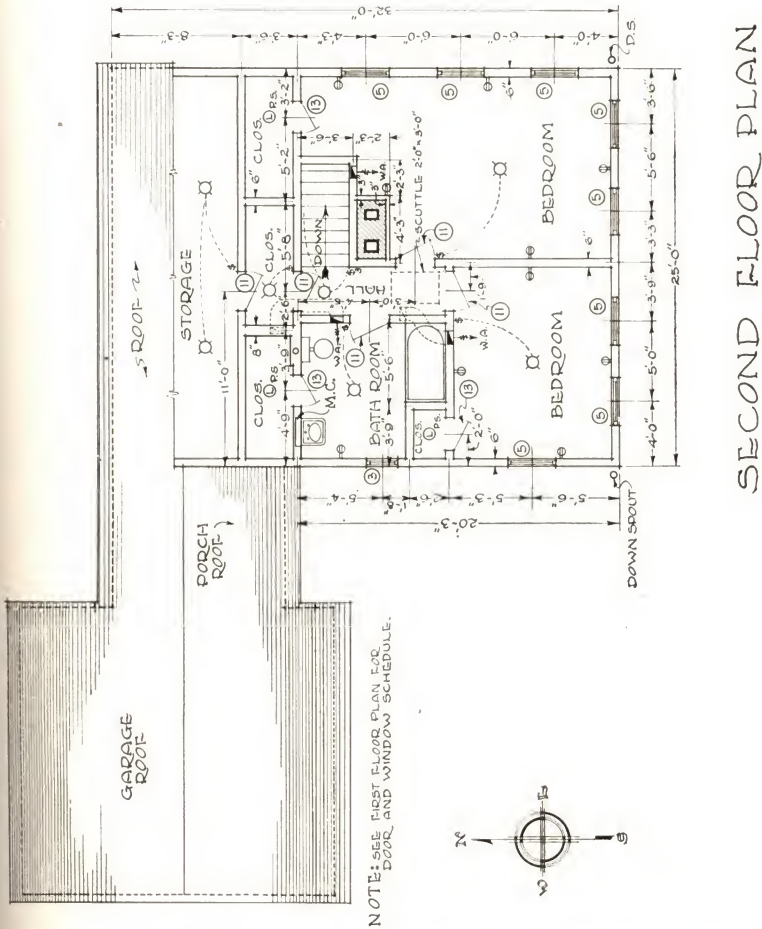


Fig. 74B, Plate 2. Second-Floor Plan of House Shown in Fig. 73A, After Remodeling
Courtesy of Walter B. Kirby, Architect

Item 6. If additional rooms, porches, and a garage are desired (see *Remodeling Requirements*), a house such as that shown in Fig. 73A would require the addition of one or more wings. Our preliminary thinking in this case would be to determine where the wing or wings would be added, and whether they would be in keeping from the architectural viewpoint.

Wings were described in Chapter I and will be mentioned again in Chapter V. A typical wing, for porch and garage, is shown in Plate 1, Fig. 74B.

Item 7. This item, of course, would not be included when the house to be remodeled is already a full two stories.

Item 8. This item, also, would be disregarded when the house to be remodeled is already a full two stories.

Item 9. Many old or poorly designed houses are disfigured by an appearance of too much height. Our preliminary thinking in connection with the remodeling of such a house should consider how to correct this impression of severe height. (See Chapter I.)

Item 10. Shutters are pleasingly consistent with many types of architecture, as shown in Chapter I.

Item 11. Some types of architecture, as explained in Chapter I, demand specific window locations. This is an important preliminary consideration.

Item 12. The modern trend in design of exteriors is toward little if any overhang of eaves. We must consider this wherever necessary.

The other items shown in the outline, as well as all items involved in remodeling work, require the same kind of careful preliminary thinking as explained for the first twelve. If you will check any house you intend remodeling, with this outline, it will help you in giving each item consideration.

The following comprises a checklist of interior items commonly changed, rebuilt, or built, in remodeling.

B. OUTLINE FOR INTERIOR REMODELING (FLOOR PLANS). Change room arrangements and sizes, add rooms and closets, to make the house fulfill requirements for modern living.

1. Inspect the old house thoroughly to determine:
 - a) Size and spacing of joists
 - b) Directions in which joists run
 - c) Locations of bearing partitions
 - d) Supporting columns in basement
 - e) Condition of floors
 - f) Condition of trim
 - g) Condition of stairs
 - h) All other structural details
2. Make larger living room.
3. Add interior garage.
4. Add bedrooms.
5. Add recreation rooms.
6. Add third-floor rooms.
7. Redesign kitchen.
8. Take out pantry and add modern cupboards in kitchen.
9. Add breakfast nook.
10. Add studio room.

11. Add powder room.
12. Add bathrooms.
13. Add shower baths.
14. Rearrange bedrooms and baths for privacy.
15. Add dressing room for master bedroom.
16. Add closets.
17. Add closet shelves and modern clothes hangers.
18. Add linen closets.
19. Add clothes chute.
20. Add millwork, such as book cases, china cabinets, wardrobes, etc.
21. Add modern wiring and electrical outlets.
22. Make new floors.
23. Add fireplaces.
24. Change room locations.
25. Change stairs.
26. Add windows for better light and cross ventilation.
27. Add insulation.
28. Install new heating system.
29. Add air conditioning.
30. Excavate additional basement space.
31. Add foundation waterproofing and drainage.
32. Add basement toilet.
33. Add closet storage space in basement.
34. Decorate.

These items are typical of those that would be considered in remodeling interiors. They are listed to show what interior remodeling is, and to serve as a guide in the preliminary thinking required for any remodeling job.

EXAMPLE. Starting with the old house in Fig. 73B, our preliminary thinking can be carried out somewhat as follows, in conformity with this outline for remodeling interiors.

Item 1. Before we can give much thought to changes and additions, we must determine the structural details and the condition of the existing house. Much depends, in any remodeling job, first of all on the structural details. This is further explained in Chapters VII and XVI.

Item 2. The tendency in modern houses is to design large living rooms which serve as the family gathering place, as well as the area for entertaining. Sometimes this increase in size can be achieved by combining two rooms. For example in Fig. 73B we might combine the existing dining and living rooms to create an excellent living room.

Item 3. Now that fireproof materials can be obtained readily and in great variety, it is entirely safe to incorporate the garage as a part of the house. This is very convenient, and makes possible the easy heating of the garage. For Fig. 73B the addition of an interior garage is not possible unless a new wing is added.



Fig. 75A. Typical Basement in Old House
Courtesy of U. S. Gypsum Company, Chicago, Ill.

Item 4. Bedrooms can be added in attic spaces by the use of dormers, or by adding a new wing or main addition to the house. To increase the number of bedrooms in the house represented in Fig. 73B, we would have to build either a wing or a new main addition.

Item 5. Recreation rooms often can be added by using waste basement



Fig. 75B. Basement of Fig. 75A, After Remodeling
Courtesy of U. S. Gypsum Company, Chicago, Ill.

space, especially where modern fuels and firing apparatus are used. In Fig. 73B the entire area under the old dining and living rooms could be made into a recreation room.

Figs. 75A and 75B illustrate what can be done to a basement by remodeling. The recreation room becomes a valuable addition to the house.

Item 6. Attic space can be remodeled to provide rooms for various purposes, in addition to bedrooms. Figs. 76A and 76B illustrate one way of making attractive use of waste space in attics.

Item 7. With present-day kitchen equipment available at reasonable prices, kitchens can be remodeled or added, that are beautiful, easy to keep clean, and models of convenience. Figs. 77A and 77B show the results obtainable for the average kitchen.



Fig. 76A. Typical Attic Space in an Old House

Courtesy of U. S. Gypsum Company, Chicago, Ill.

For all the other items in the outline for interior remodeling, our preliminary thinking would proceed in much the same manner. Again, if you will check whatever work you have in mind with this outline for interior remodeling, it will aid you in giving proper consideration to each item involved.

II. EXTENSIVE ALTERATIONS, INTERIOR—LITTLE, EXTERIOR.

This division is referred to as partial remodeling because extensive

changes are made in the interior, but little is done to the exterior. In other words, while the interior is made completely different in appearance to conform with the homeowner's desire for change, the exterior looks somewhat the same after remodeling as it did before the work was begun.

Fig. 78A shows the exterior of an old house, prior to partial remodeling, and Fig. 78B shows the same house after partial remodel-



Fig. 76B. Attic Space of Fig. 76A, After Remodeling

Courtesy of U.S. Gypsum Company, Chicago, Ill.

ing. Fig. 79A shows the floor plans for Fig. 78A, and Fig. 79B shows the same plans after remodeling.

From a study of Figs. 79A and 79B you will see that the interior is entirely different in appearance from the original, after the extensive changes have been made. Figs. 78A and 78B, on the other hand, indicate that little structural change was made in the original elevations. The roof of the wing or ell was raised, a new front porch built, the eave overhang shortened, new siding applied, and new shutters added.



Fig. 77A. Typical Old-Style Kitchen
Courtesy of U.S. Gypsum Company, Chicago, Ill.

Compared with Figs. 73A and 74A, the amount of structural change in Figs. 78A and 78B is small.

The blueprints in the back of the book present another good example of partial remodeling, in that extensive changes are shown in the remodeled floor plans, and slight changes only in the elevations.



Fig. 77B. Kitchen of Fig. 77A, After Remodeling
Courtesy of U.S. Gypsum Company, Chicago, Ill.



Fig. 78A. Typical Old Frame House

Courtesy of U.S. Gypsum Company, Chicago, Ill.

A. OUTLINE FOR REMODELING INTERIORS. The outline shown under complete remodeling, for interiors, can be used here also. However, you must bear in mind that in partial remodeling all changes in the interior must conform to existing elevations, except in cases where roofs are raised, as in Fig. 78B. This means that the remodeling of interiors must depend largely on rearrangement of partitions, and better use of spaces that have been wasted previously, as under

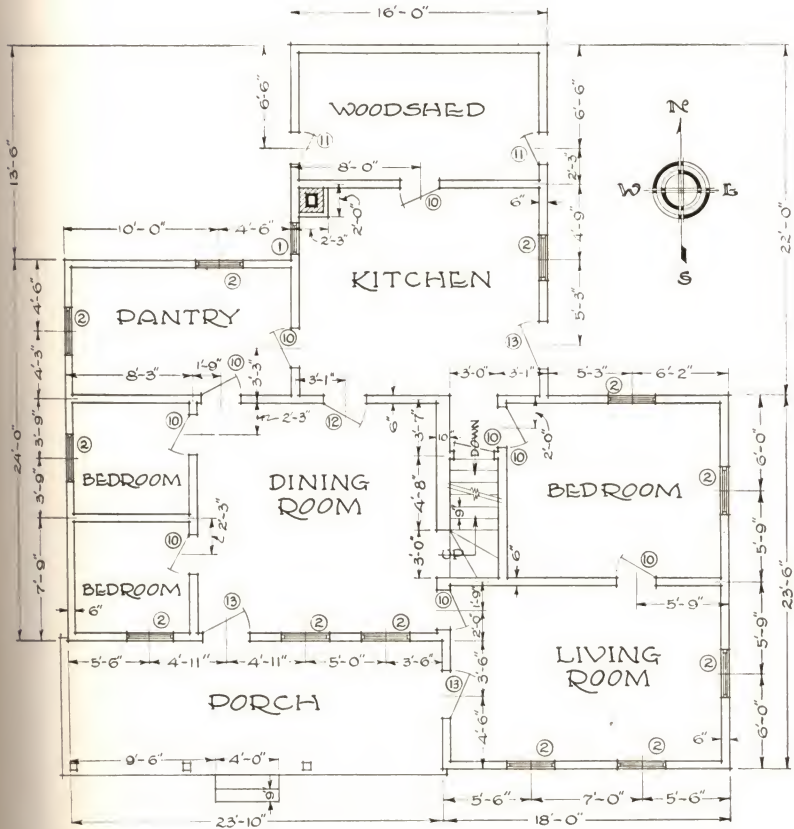


Fig. 78B. House Shown in Fig. 78A, After Remodeling

Courtesy of U.S. Gypsum Company, Chicago, Ill.

WINDOW SCHEDULE	
①	DOUBLE HUNG 2'-0" x 5'-2" 2 LTS.
②	DOUBLE HUNG 3'-0" x 5'-2" 2 LTS.
○	
○	
○	

DOOR SCHEDULE	
⑩	2'-6" x 6'-8"
⑪	2'-0" x 6'-8"
⑫	2'-8" x 6'-8"
⑬	3'-0" x 7'-0"
○	



NOTE: OLD HOUSE NOT
WIRED FOR ELECTRICITY
OR PIPED FOR GAS.

FIRST FLOOR PLAN

Fig. 79A, Plate 1. First-Floor Plan for House Shown in Fig. 78A
Courtesy of U.S. Gypsum Company, Chicago, Ill.

roofs. Sometimes, as in Fig. 79B, part of the old elevation is entirely removed. The removal of the woodshed shown in Plate I of Fig. 79A has decreased the floor area shown in Plate I of Fig. 79B. However, dining rooms are often omitted in favor of dining alcoves, as in this instance, which helps make up for areas thus lost by changes in elevations.

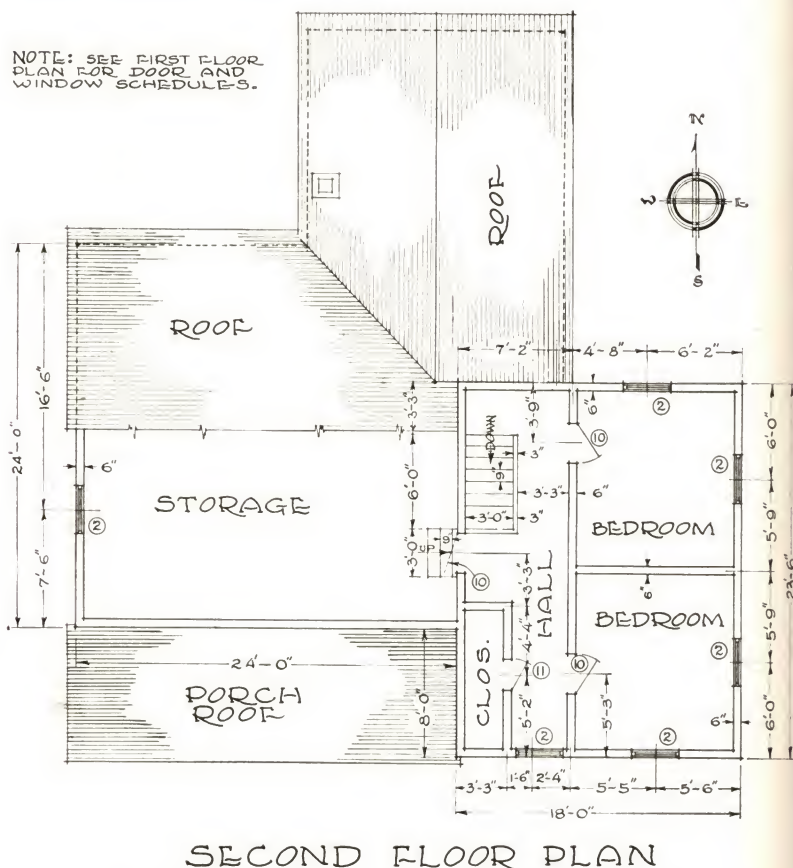


Fig. 79A, Plate 2. Second-Floor Plan for House Shown in Fig. 78A

Courtesy of U.S. Gypsum Company, Chicago, Ill.

The following comprises a checklist of typical items included in the partial remodeling of exteriors.

B. OUTLINE FOR PARTIALLY REMODELING EXTERIORS (ELEVATIONS).

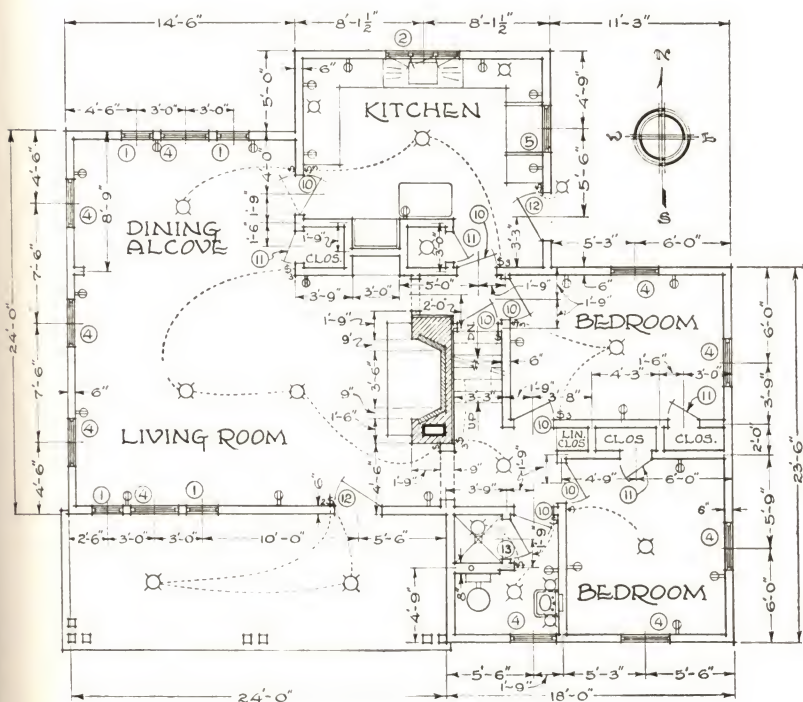
Make changes, to improve appearance of the house, that do not necessitate much structural alteration.

1. Reduce overhang of eaves.

2. Rebuild chimney above roof to improve its appearance and proportions.
3. Build new exterior ornamental chimney to serve both fireplace and furnace.

WINDOW SCHEDULE	
①	DOUBLE HUNG 2'-0" x 5'-2" 12 LIGHTS
②	CASEMENT 4'-7 $\frac{3}{4}$ " x 3'-3 $\frac{3}{4}$ " 18 LIGHTS
③	DOUBLE HUNG 2'-0" x 4'-0" 2 LIGHTS - GLAZED GLASS
④	DOUBLE HUNG 3'-0" x 5'-2" 12 LIGHTS
⑤	DOUBLE HUNG 3'-0" x 3'-0" 12 LIGHTS

DOOR SCHEDULE	
⑩	2'-6" x 6'-8"
⑪	2'-0" x 6'-8"
⑫	3'-0" x 7'-0"
⑬	2'-6" x 6'-0" GLASS SHOWER DOOR



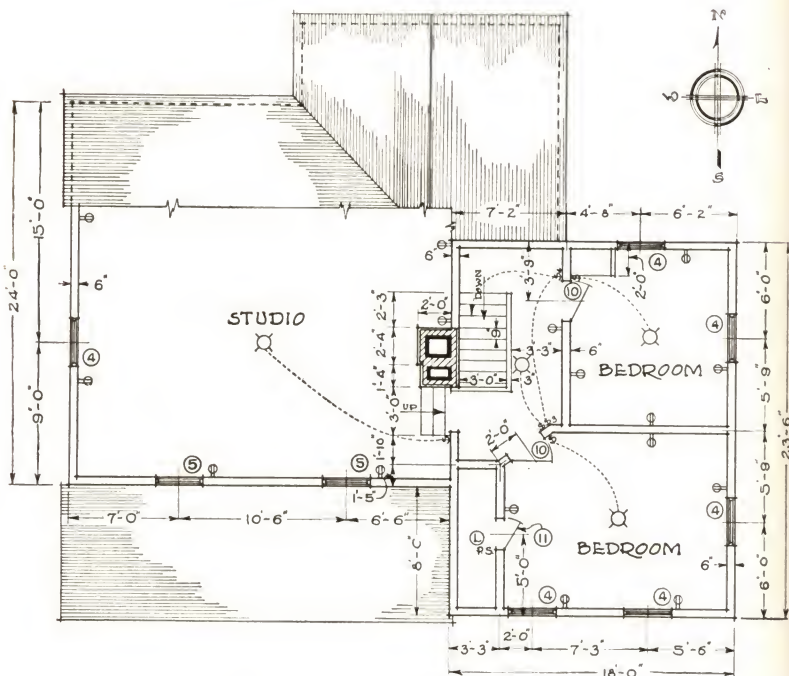
FIRST FLOOR PLAN

Fig. 798, Plate 1. Remodeled First-Floor Plan for House Shown in Fig. 78A

Courtesy of U.S. Gypsum Company, Chicago, Ill.

4. Add garages.
5. Take off old-style porches.
6. Build new porches.
7. Apply new shingles or other roofing material.

8. Renail shingles and siding.
9. Add new siding, shingles, or other exterior surface materials.
10. Install new standard millwork entrance and entrance details.
11. Change entrance from one side to another, if new orientation for rooms is required.
12. Put in new door and window frames.
13. Apply shutters to windows.
14. Remove old bay windows.



SECOND FLOOR PLAN

Fig. 79B, Plate 2. Remodeled Second-Floor Plan for House Shown in Fig. 78B

Courtesy of U.S. Gypsum Company, Chicago, Ill.

15. Reduce size of old windows.
16. Remove old window glass and replace with divided lights.
17. Add new glass, hammered, to bathrooms and other rooms where privacy is required.
18. Install good weatherstripping for all doors and windows.
19. Make and install new screens.
20. Make awnings for windows on sunny side of house.
21. Put on new downspouts.

22. Add decorative louvres.
23. Point up all brickwork.
24. Repaint.
25. Install outside electric meter.
26. Regrade lot. This may mean putting earth around the foundation so that the house will not appear so high above the ground.
27. Add basement windows and any necessary areaways.
28. Apply cement mortar to old rubble foundation to make it appear like concrete or concrete blocks.
29. Build outside terraces.
30. Put up new decorative fences.
31. Install trellis work.
32. Install flower boxes.

These items are typical of those that should receive serious consideration, in preliminary thinking about partial exterior remodeling. They will serve as a checklist, as explained in connection with previous outlines. No explanations are given relative to any of these partial remodeling items, as you will find them self-explanatory, if studied in connection with Figs. 78A and 78B, and the blueprints in the back of the book.

III. MODERNIZING EQUIPMENT AND DECORATING. There are many houses which, if modernized as to mechanical equipment and decoration, would become sufficiently modern for all practical purposes. Such houses are those which were carefully designed in accordance with a traditional type of architecture and in a conservative manner.

This classification of improvement work, therefore, requires no serious structural changes to a house. In other words, a modernized house is one in which there have been no exterior structural changes, and no rearrangement of rooms or other interior structural changes of any consequence. The changes are mostly in mechanical equipment, plumbing, heating, and decorating.

The following comprises a checklist of typical items involved in modernizing a house of good design.

A. OUTLINE FOR MODERNIZING A HOUSE. Modernize all equipment and redecorate.

1. Install modern equipment in kitchen.
2. Apply linoleum to walls and floor in kitchen.
3. Install ventilating fan in kitchen.
4. Install casement windows in kitchen.
5. Install new electric outlets in kitchen, also new lights.

6. Install breakfast nook in place of old pantry in kitchen.
7. Install built-in ironing board.
8. Install new bathroom fixtures.
9. Apply tile to bathroom floor and walls.
10. Install shower bath.
11. Apply any one of several special products, such as linoleum, pressed wood, manufactured woods, etc., on bathroom walls.
12. Install medicine cabinets.
13. Install new bathroom lights and electric outlets.
14. Change first-floor closet or old pantry to powder room, or space for water closet and wash basin.
15. Install swinging door between kitchen and dining room.
16. Install built-in cabinets in dining room.
17. Install new light fixtures and electric outlets.
18. Rebuild old fireplace with modern materials.
19. Build recreation room in basement or attic.
20. Screen or glaze in porches.
21. Install modern garage doors.
22. Repaint all exterior wood.
23. Cut in new windows for cross ventilation.
24. Build dressing rooms by decreasing areas of larger bedrooms.
25. Install cedar linings for closets; install modern means of hanging clothes, storing shoes, etc.
26. Build in linen closet.
27. Patch up all interior plaster.
28. Canvas badly cracked, plastered walls.
29. Repaper all walls.
30. Refinish all ceilings.
31. Repaint all interior trim.
32. Refinish floors.
33. Paint all radiators.
34. Paint attic and basement stairs.
35. Refinish main stairs.
36. Refinish doors, inside window sash and trim, and built-in woodwork.
37. Resurface worn floors with linoleum, tile, carpet, thin finish flooring, or other materials.
38. Install new incinerator.
39. Install new heating and ventilating system.
40. Install new automatic firing equipment for furnace.
41. Install automatic hot-water heater.
42. Install hot-water coils in furnace.
43. Install new laundry trays, laundry stove, and other equipment.
44. Install new laundry driers.
45. Install water softening systems.
46. Install footing drains to keep basement dry.
47. Waterproof foundations.

The foregoing outline will give you an idea of the factors to be considered in modernizing. Individual cases will probably bring out

items not mentioned here, but the list is complete enough to serve as a guide in any ordinary modernizing job.

EXAMPLE. Mention of the following few items will indicate the lines of our preliminary thought in relation to the outline given.

Items 1 to 7. Most kitchens in homes built fifteen or more years ago were equipped with sinks, stoves, ice boxes, and a pantry. Usually the important pieces of equipment were so unwisely placed that the housewife was required to make hundreds of wasteful and tiring steps in doing her work. These older kitchens were unnecessarily large, also, taking up space which could well be used for



Fig. 80. Modern Kitchen

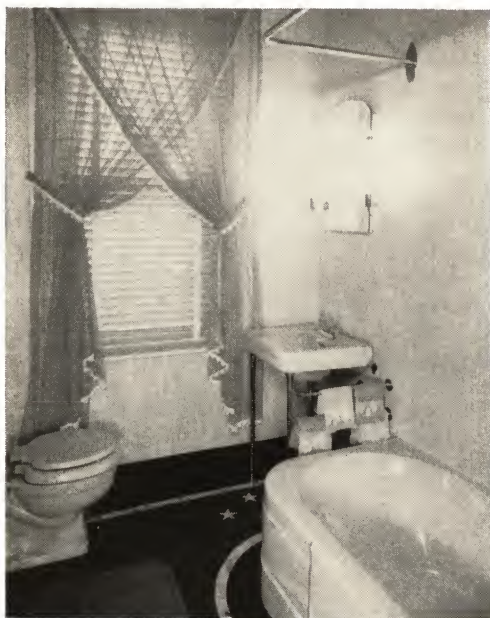
Courtesy of Curtis Companies, Inc., Clinton, Iowa

other rooms. The old-fashioned pantries also took up space; they were not convenient because they were too far from the work center; and they were hard to keep clean.

Fig. 80 shows a modern, well-planned kitchen, arranged in comparatively small space for convenience, cleanliness, and beauty. (See Chapter XII on the design of kitchens.) The floor is linoleum covered, there are ample storage cabinets and work boards, and there is every piece of mechanical equipment required by modern standards.

Items 8 to 14. The old-style bathroom, with its four-legged tub, hung wash basin, incorrect wall surfacing, inefficient lighting, badly treated windows, ugly radiators, poor floor, and makeshift shower can be modernized very easily. Figs. 81A and 81B show the transformation which can be brought about. The

modernized bathroom is a thing of beauty, but, like the modernized kitchen, it can only result after thorough preliminary thought is given to each of the details involved.



Below, Fig. 81A. Typical Old-Style Bathroom

*Courtesy of Crane Company,
Chicago, Ill.*

Above, Fig. 81B. Bathroom of
Fig. 81A, After Remodeling

*Courtesy of Crane Company,
Chicago, Ill.*



IV. PUTTING A HOUSE IN GOOD REPAIR. This classification of improvement work does not include any structural changes or any modernizing, but it is considered under remodeling because many old houses of good design and satisfactory size and arrangement do not need anything but thorough repairing to put them in perfect condition.

A. OUTLINE FOR REPAIRING A HOUSE. The following will serve as a checklist in considering the items in a house which may require repairing:

Basement

1. Are all locks, windows, doors, and lights in good order?
2. Does stairway need repair, or a new handrail?
3. Are floor drains working?
4. Do foundations require repairing or painting?
5. Is basement clean and well painted?
6. Does hot-water system work satisfactorily?
7. Are laundry trays ample?
8. Do heating or cold-water pipes need insulation repair?
9. Is waterproofing or footing tile required to avoid dampness?
10. Is heating system working properly?
11. Are there ample storage facilities?

Furnace

1. Should cover for fire protection be added?
2. Is a new smoke pipe required?
3. Are grates in good condition?
4. Does furnace need cleaning?
5. Are hot-air pipes airtight at all joints?
6. Do all valves function properly?
7. Are burners in adjustment?
8. Are thermostats satisfactory?

Electric Wiring

1. Are all wires protected?
2. Do all switches work?
3. Have wires been broken or pulled away from insulators?
4. Do all pull chains operate?
5. Are any lamp cords worn through to the bare wires?

Plumbing

1. Do all shutoff valves work?
2. Are all cleanout facilities in order?
3. Do faucets need new washers?
4. Do flush tanks need new floats or rubber accessories?
5. Do all drains work freely?

Kitchen

1. Does range, including oven regulator, function properly?
2. Does refrigerator function properly?
3. Are kitchen door, windows, and locks satisfactory?
4. Are shelves and cupboards in good condition and well painted?
5. Is floor covering all right?
6. Does exhaust fan function?
7. Are kitchen lights and electric outlets sufficient?
8. Does the door leading to dining room swing properly?
9. Does back porch need repair?
10. Is redecorating necessary?

Dining Room

1. Do window shades need repair?
2. Is redecorating necessary?

3. Are all lights and switches satisfactory?
4. Is floor in good condition?

Living Room

1. Is redecorating necessary?
2. Do windows require attention?
3. Are bookcases and other built-in equipment in good condition?
4. Is the floor in good shape?
5. Is there a crack between baseboards and floor which needs attention?
6. Do all doors swing easily?

Closets

1. Are hangers, hooks, and clothes rod needed?
2. Is repainting required?
3. Should built-in storage for hats, shoes, and other belongings be added?
4. Should lights be installed in the closets?

Bedrooms

1. Is redecorating necessary?
2. Are mirrors on doors in good condition?
3. Is closet space sufficient?
4. Do all doors and windows open and lock satisfactorily?
5. Is any glass broken?

Bathrooms

1. Should floors be recovered or refinished?
2. Do all fixtures work?
3. Is there ample heat?
4. Is redecorating necessary?
5. Are clothes hooks needed?
6. Are convenience outlets provided?
7. Is medicine cabinet in good shape?
8. Do lights give proper light for shaving?
9. Is the window glass opaque in bathrooms?
10. Does tile need repair?

Attic

1. Are stairs in good condition?
2. Is chimney in repair?
3. Are windows in need of attention?
4. Are storage facilities ample?
5. Is the roof or the floor properly insulated?

Exterior Walls

1. Does the brickwork need pointing?
2. Does the stucco work require repair?
3. Is repainting necessary?
4. Is siding weathertight and sound?

Roof

1. Is the roofing in good condition?
2. Is all flashing intact and painted?
3. Is chimney at least two feet above peak of roof?
4. Are all gutters and downspouts in good condition?

Miscellaneous

1. Is all hardware in proper order?

2. Do all window sash cords function properly?
3. Are shutters in good condition?
4. Is porch roof watertight?
5. Are all exterior steps safe?
6. Are walks and drives in good condition?
7. Are fences in good repair?
8. Do the garage doors work properly?
9. Is a new radio antenna needed?
10. Are lightning arrestors properly connected to ground?

IS REMODELING WORTH WHILE?

The question as to whether or not remodeling is worth while should be given much preliminary consideration. Indeed, after what constitutes remodeling is clearly understood, the question as to whether it is worth while comes next in order of importance. There are many sides to this question, all of which cannot be anticipated here. The items outlined herein are typical, however, and will serve as a checklist, as well as an aid in deciding whether the remodeling of your own house, or the one you are thinking of purchasing to remodel, or the one you are planning to remodel for someone else will be worth while. The outline assumes, as is usually the case, that financial considerations are of first importance, and that determining the total cost you can allow for remodeling must precede all preliminary thinking.

During your preliminary thinking, when considering whether or not remodeling would be worth while, there are three general divisions of thought to follow:

1. Desirability of remodeling from the standpoint of obtaining a loan with which to do the work.
2. Desirability from the standpoint of renting or selling the house.
3. Desirability from the standpoint of living in the house and making it better suit your requirements.

OBTAINING A LOAN. As explained in succeeding pages, there are many organizations and institutions that are anxious to loan money for remodeling purposes. However, any project for which they loan money must possess certain desirable or satisfactory qualifications. Therefore, it is well to know what constitutes such qualifications and thereby be better able to judge the chances of securing a loan.

OUTLINE FOR USE IN DETERMINING QUALIFICATIONS OF A HOUSE IN TERMS OF SECURING A REMODELING LOAN. The following comprises a typical checklist of items which determine the qualifications of a house for obtaining a remodeling loan.

Neighborhood

- | | |
|------------------------------|--------------------------------|
| 1. Residential | 15. Stores |
| 2. Part business | 16. Churches |
| 3. New or old | 17. Transportation |
| 4. Types of buildings | 18. Playgrounds |
| 5. Zoning restrictions | 19. Recreation |
| 6. Character of people | 20. Revived neighborhood |
| 7. Percentage of home owners | 21. Utilities |
| 8. How kept up | 22. Improvements |
| 9. Safety | 23. Water and sewer |
| 10. Streets and sidewalks | 24. Highways |
| 11. Noise | 25. Surrounding property value |
| 12. Fire protection | 26. Future development |
| 13. Police protection | 27. Taxes |
| 14. Schools | 28. Soil conditions |

Additional Considerations

- | | |
|---------------------------|------------------------|
| 1. Condition of old house | 2. Remodeling proposed |
|---------------------------|------------------------|

In the following paragraphs a few of the neighborhood items are explained to show how to carry on the necessary thinking, preliminary to obtaining a loan.

Item 1. A remodeled house in a strictly residential neighborhood has a greater desirability than one located next door to or across the street from stores. If business houses are very near, the noise, crowding, parking difficulties, and appearance of the immediate surroundings are not agreeable to the great majority of people. Thus, a house in an unsatisfactory neighborhood would be a poor risk to a lending institution and might prove a white elephant (loss); for if a loan were granted and the payments were not kept up, the house would be eventually turned over to the lender.

Item 2. As indicated in the foregoing discussion a business neighborhood might not be an aid in obtaining a remodeling loan. However, if the business in the immediate vicinity were of such a nature that it would cause little crowding or noise and if the business buildings were not objectionable in appearance, the desirability of the house in question might not be seriously affected. Restaurants, taverns, and theaters usually cause noise and crowding, especially at night, which many people will not tolerate.

Item 3. The age of a neighborhood and whether most of the houses are new or old is of importance. A neighborhood composed mostly of new houses is a decided asset toward obtaining a loan for remodeling. Improvements will raise its value and it becomes a decidedly good risk. If old houses predominate, their state of repair, type of architecture, and size must be taken into consideration.

Item 5. Desirable neighborhoods are protected by zoning laws against busi-

ness or apartment buildings, and other elements detrimental in a residence section. This item has an important bearing on loan possibilities.

Item 9. If the house in question is located so as to be free from unusual danger from fire, flood, erosion, and similar forces, it is in a more favorable position for obtaining a loan.

Items 12 and 13. Fire and police protection make any neighborhood of greater value, reduce insurance rates, and add to its desirability. These are important items.

Items 14 through 19. If a neighborhood is so located that schools are within easy walking distance, and stores and churches are within reasonable distances, these add greatly to its desirability and thus to its value in the eyes of most people. Transportation is of great importance, and the nearness of one or more types of public transportation increases the value of any neighborhood. In fact, the great majority of people will not live in a neighborhood where good transportation is not within easy walking distance. Playgrounds for children, and recreational centers for children and adults, add considerably to the value of a neighborhood, so long as they are not too near the home that is to be remodeled.

Item 20. Some neighborhoods which are rather old may become revived through certain shifts in trends of business, highways, transportation, and similar factors. In such cases values go up, and the remodeling of a house in that neighborhood becomes desirable, and a good risk for any lending institution.

Item 24. Houses located on state or federal highways, or on principal city streets, usually are subject to considerable noise both day and night. This would be likely to make even a completely remodeled house undesirable to most people.

The foregoing items do not constitute a complete or accurate outline of requirements or other factors affecting loans. Each lending institution has its own ways of appraising houses, based on its own experience. However, the items given are typical and merit careful preliminary thought in deciding whether remodeling is worth while.

If you propose only to modernize or repair, the foregoing outline is not nearly so important, and your own credit rating is the deciding factor in obtaining a loan.

RENTING AND SELLING. To remodel a house so as to make it more readily rentable or more easily salable—either at a profit—requires the same type of preliminary thinking because in both cases the improvements are aimed at making the house more desirable in the eyes of as many people as possible.

If a house is situated in a desirable neighborhood, remodeling will pay a profit if it is done so as to attract favorable attention.

Renting. In a nation-wide study of the dollars-and-cents value of remodeling, average rental increases, which real estate operators believe will result from certain types of remodeling, were determined. These are shown briefly in Table 2.

Table 2. Rental Increases Due to Remodeling

Type of Remodeling	Estimate of Average Rental Increase
Adding an extra bathroom.....	13.74%
Modernizing the present bathroom.....	8.88%
Modernizing the kitchen.....	10.66%
Installing automatic heat.....	13.40%
Building new or enlarging present garage.....	8.98%
Adding a sleeping porch or sun porch.....	11.07%
Redecorating the interior (refinishing walls, ceilings, woodwork, floors, etc.).....	13.22%
Resurfacing or painting the exterior (asbestos or asphalt siding, paint stucco, etc.).....	10.87%
Insulating the house.....	9.80%
Finishing the basement (recreation room, workroom, playroom, bar, etc.).....	9.91%
Finishing the attic (extra bedroom, nursery, maids room, game room, etc.).....	11.40%
Adding a third bedroom.....	15.35%
Rearranging interior floor plan (the better to use existing space).....	17.38%

Courtesy of U. S. Gypsum Co., Chicago, Ill.

It was also found in the nation-wide study that the *average* rental value of an older house with six rooms is about \$40 per month; for an older house with five rooms the *average* rental value is about \$32 a month.

Suppose an additional bathroom is added to an older house with six rooms. According to Table 2 the rental would be raised 13.74, call it 14, per cent. Thus, the rental could be advanced from \$40 to \$45.60 per month. In the five-room house, the rent would advance from \$32 a month to approximately \$36.50.

Selling. It is a generally accepted rule that rent should return about 12 per cent on the investment. Thus, value should represent about $8\frac{1}{3}$ times the rental of a house, so that if a house rents for \$1,200 a year its worth should be \$10,000. Therefore, if a six-room house has an average rental value of \$40 per month (\$480 per year), it should be worth \$4,000. If an additional bathroom is put in, the rental value increases 14 per cent, and the house should be worth about \$4,500.

Although these figures should be used only as a guide to thinking, they can and do represent approximately the increased amounts for

which a house can be sold after remodeling, not to mention its increased desirability.

OWNER'S STANDPOINT. If you are the owner but do not intend to rent or sell, the considerations of financial gain still apply as in remodeling a house for renting or selling. A home is one of the most important financial assets in most people's lives, ranking second only to life insurance. As a means of raising money for which sudden need has arisen, a well-kept modern home serves a useful purpose because, with the home as security, negotiations for a loan are comparatively easy to make.

In addition to the outline for remodeling, consisting of items which should receive preliminary thought in connection with any job of remodeling, there are some items which ought especially to be considered if you are the owner and intend to make the remodeled house your own home. These consist of improvements designed to adapt the house to the comfort, taste, convenience, and pleasure that you and your family desire. This might be called a supplementary outline, to serve as a checklist of special remodeling items, and to be used as a supplement to the outlines for remodeling previously given in this chapter.

SUPPLEMENTARY OUTLINE FOR REMODELING FOR OWNER'S USE.

1. Provide offices, for doctor or other professional man.
2. Provide hobby room, shop, or studio.
3. Provide den, study, or library.
4. Provide game room or recreation area.
5. Provide health facilities, including sun decks.
6. Provide space for flower gardens.
7. Provide space for tennis or other outdoor games.
8. Plan special rooms for children.
9. Add toy closet.
10. Add maid's room.
11. Provide extra bathroom facilities.
12. Facilitate house cleaning and care.
13. Rebuild sinks and similar equipment to heights convenient to those who use them.
14. Arrange for more natural light and improve artificial lighting.
15. Add heavy glass shingles to give light in attic.
16. Make areaways around basement windows for more light and air.
17. Provide nonfreezing windows.
18. Provide Venetian blinds.
19. Choose modern decoration.
20. Install new and beautiful floors.

21. Provide for better furniture arrangement and modern materials.
22. Add picture windows.
23. Add recess radiators.
24. Reduce sound travel to upper floors by absorptive ceilings on first floor.
25. Insulate walls or place bathrooms to provide privacy.
26. Air condition.
27. Provide modern mechanical equipment.
28. Save fuel by insulation.
29. Put in three-way switches for stairs.
30. Put night lights in stair baseboards.
31. Install electric heater in bathroom wall.
32. Install no-fuse circuit breaker.
33. Install lightning arrestors.
34. Convert one-pipe steam system to a vapor system.
35. Provide fire stops.

It is hardly necessary to explain the foregoing items, as most of them are self-explanatory. You can study many of them, moreover, in the various before and after pictures throughout this book.

You are advised to plan improvements so that the resulting house will be beautiful but conservative. Avoid gadgets and designs that might satisfy a momentary desire for something different; choose in favor of what would be most likely to please the most people over a period of time. Newspapers and magazines are a constant source of information and advice as to what is considered good taste and sound planning in remodeling and decoration.

The purchase and remodeling of an old house can be made a most profitable and enjoyable enterprise, provided that you will give careful preliminary thought to the fundamentals outlined in this chapter, and that you faithfully follow the sound principles of the succeeding chapters.

REMODELING REQUIREMENTS

In the preceding section of this chapter it was concluded that remodeling would be worth while only if sound preliminary thinking were given to all of the items involved, before any plans were drawn or construction started.

Remodeling requirements constitute an important division of this preliminary thinking; unless they have been carefully determined, a remodeled house, no matter how much you have spent on it, will be a disappointment inasmuch as some of your requirements have not been met.

What are remodeling requirements? They are whatever you hope to accomplish by the remodeling work. They are the extra bedrooms, additional bathrooms, larger living rooms, modernized exteriors, recreation rooms, increase in property value, decrease in renting troubles, and in general all that makes for more satisfactory home ownership.

PERSONAL REQUIREMENTS. In the following, some suggestions are offered, to help you carry on preliminary thinking as to the remodeling requirements. The requirements of all members of a family should be carefully studied, considering their personal needs, as well as their collective needs. In other words, thought must be given to what space and facilities are required by each member, and what rooms and equipment the house must have in order to meet these personal requirements.

Husband and Wife

1. Do they prefer one master bedroom, or separate rooms?
2. Are one or two bathrooms required?
3. Does either require separate space to use as sewing room, sitting room, den, or office?
4. What provision must be made for hobbies?
5. What dressing room facilities are required?
6. What closet and storage spaces are desirable?
7. Are showers, as well as tubs, required in the bathroom or bathrooms?
8. Will twin or double beds be used?
9. What other furniture will be required?
10. What mechanical equipment is required?
11. Is a sleeping porch desirable?
12. Is noise an important item?
13. What decorating is agreeable to both?
14. In what part of the house should the room or rooms be located?

Children

1. How many bedrooms are required?
2. What future bedroom needs is it wise to provide for?
3. Are provisions for an upstairs playroom desirable?
4. Will children use main bathroom or is an additional bathroom needed?
5. Are separate dressing rooms required?
6. What kind and size of beds are necessary?
7. What other furniture must be accommodated?
8. What closet and storage space is required?
9. What special equipment is necessary?
10. What part of house should rooms be in?
11. Which particular room will be assigned to each child?

Maid

1. Is the maid to sleep in?

2. If more than one servant, will they share rooms or require separate rooms?
3. Is a servants' bathroom necessary?
4. What closet and storage facilities are necessary?
5. What furniture must room or rooms accommodate?
6. What part of house will room or rooms be in?

Guests

1. Will one or more such bedrooms be necessary?
2. Will guest rooms require adjoining bathrooms?
3. What closet space is required?
4. Are dressing rooms required?
5. What furniture must the room accommodate?
6. What part of house will room or rooms be in?

Other Residents

1. Relationship?
2. Age?
3. Interests and recreation?
4. One or two rooms required?
5. Furniture?
6. Closet and storage space?
7. Part of house?
8. Bathroom facilities?

The foregoing items are typical of those which must be considered in preliminary thinking of remodeling requirements.

COLLECTIVE REQUIREMENTS. Individual families may have more or different requirements, all of which should be considered. These items should be accounted for in writing, in order to avoid overlooking any important consideration. Once the personal needs of each member of a family have been determined, the rooms and facilities can be planned and allotted as agreeably as possible under existing conditions and allowable costs.

1. What general family recreations must be provided for?
2. Is a basement recreation room desirable?
3. Is space for showing motion pictures required?
4. Is space for a billiard table required?
5. Is space for Ping-pong or other games required?
6. What provision should be made for pets?
7. What furniture must be accommodated in the various rooms other than sleeping rooms?
8. What facilities such as powder room and clothes closets are required for entertaining?
9. Should the living room be large for entertaining purposes?
10. Is a large dining room required for frequent dinner parties?
11. Will kitchen equipment have to be ample to provide for entertaining?
12. Must children's parties be provided for?
13. Is a library or first-floor den desired?

14. What storage space is required for card tables, folding chairs, toys, linens, china, books?
15. What general storage spaces are required?
16. What built-in equipment is necessary?
17. Is ample laundry space for home laundering required?
18. What mechanical equipment is necessary?
19. What type of decorating is liked best?
20. What materials are preferred?
21. What type of architecture is preferred?
22. Is a one- or two-car garage desirable?
23. Are facilities desired for outdoor games?
24. Are facilities desired for flowers, gardens, terraces?

The foregoing outline will show you how to take into consideration the collective needs of the family, so that all necessary items may be anticipated in the general planning for the remodeled house.

CONSIDERATION OF ROOMS. In addition, most housewives have very definite ideas as to just what furniture they want in every room in the house. Also, there are other details which are necessary to satisfy their notions of what a house should contain and be like. Each room should be studied separately, therefore, so that it will as nearly as possible satisfy these requirements.

Living Room. A living room has two general purposes. First, it must satisfy the members of a family in terms of comfort, convenience, and relaxation. Second, it must provide for the entertainment of guests. More important than these requirements, even, is the accommodation of the furniture, because it is the furniture and furnishings which really make the room. Therefore a living room must be planned for pleasing arrangement of the required furniture.

Knowing the furniture requirements for the living room, we can study the general groupings, probably with several variations, in terms of reading, card playing, conversation, and other activities. To facilitate this study, cut out pieces of cardboard to represent the various pieces of furniture. These are called *templets*, and they must be cut to scale. For example, if the scale to be used in the floor plans is $\frac{1}{4}$ "-1'0", then the pieces representing the furniture should be drawn and cut to that same scale. Place these templets on a rough sketch of the floor plan and study various groupings. Adjustment in the proportions of the living room can then be planned for, if required.

Fig. 82 shows outlines for typical pieces of furniture, drawn to the $\frac{1}{4}$ " scale. When using the cardboard pieces in grouping or ar-

rangement studies, remember to allow ample room between pieces of furniture, for moving chairs out from tables, etc. The design of a

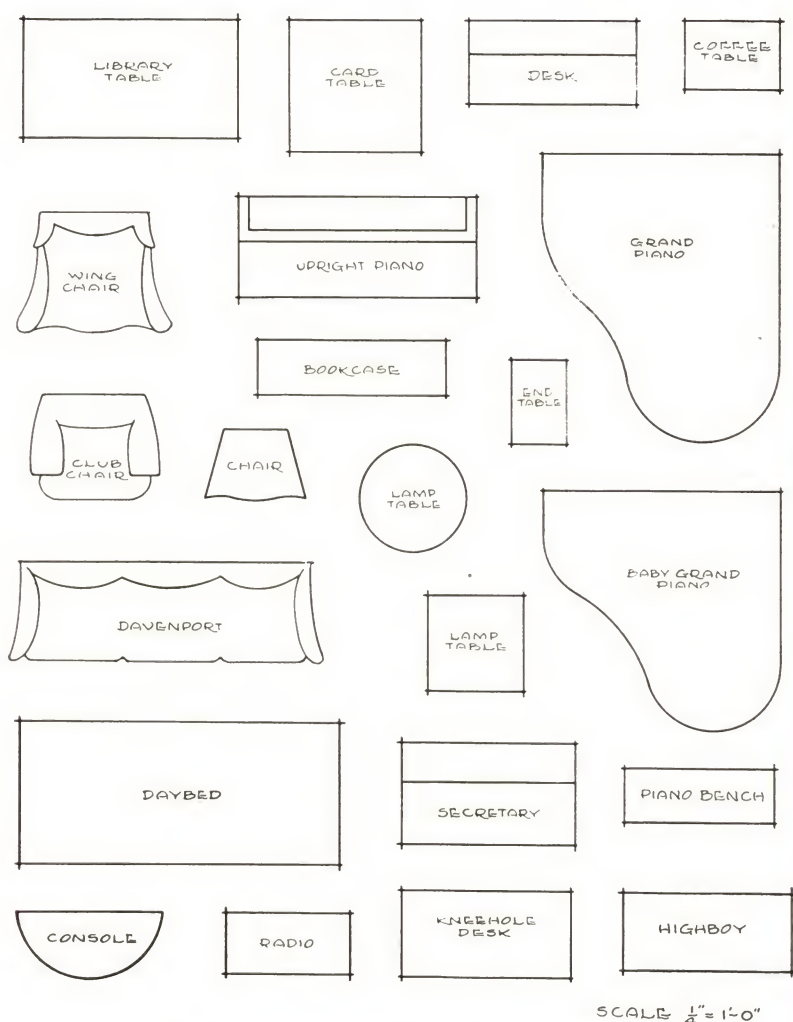


Fig. 82. Scale Drawings for Typical Pieces of Furniture

living room from the standpoint of doors, windows, and the fireplace must also be considered in relation to the grouping of the furniture.

Dining Room. The size and shape of the dining room is likewise governed somewhat by the required size of table, the necessary num-

ber of chairs and the other furniture. Windows and doors are important and must be considered. Pieces of cardboard representing dining room furniture can be cut to scale and placed on a sketch of the floor plan for study, also.

Other Rooms. As a matter of fact, the size and shape of all rooms depend largely on the necessary furniture or equipment, and we can follow the same procedure with cardboard pieces representing the furniture. Remember that furniture, unless it can be taken apart, cannot be larger than the halls and doorways through which it must pass.

The ultimate proportions of rooms may have to be governed in many cases by the type of architecture and the over-all dimensions of the house. In other words, room designs are a compromise between their requirements, the type of architecture, and the over-all dimensions. This forms an interesting study, and one deserving the most careful attention.

Room design is discussed further in Chapter XV.

MATERIALS. The materials to be used in remodeling work have much to do with the final result, also, and must likewise be given careful attention. Each room, the attic, the basement, and the exterior should be studied individually and the materials carefully planned. This should include the decorating. You will find a general discussion of materials in Chapter X. You can obtain a great deal of information about materials from newspaper and magazine articles, also, or by writing to manufacturers for catalogs and descriptive literature, or by visiting lumber yards and other places where materials are sold.

CODES AND ZONING REQUIREMENTS. Practically every city, town, and village has its own codes, ordinances, and zoning laws, and you should be familiar with these before starting to draw plans. In many instances, kinds of material and types of structures are definitely regulated. You may obtain copies of such laws upon application to building bureaus and departments.

REMODELING FOR RENTING. If you are remodeling a house for the purpose of renting it, the design of rooms and their materials should be somewhat more conservative, in order to please the largest possible number of people, and to allow for use and grouping of average furniture. The materials and decorating should be rather neu-

tral, and, in general, the rooms should be usable for ordinary purposes.

People looking at houses to rent are usually impressed by good exterior appearance, modern bathrooms and kitchens, rooms of conventional size and shape, ample natural light, privacy, automatic mechanical equipment in good repair, and modern but conservative decorating. Many of the items which would add satisfaction in remodeling for your own use are not important in the renting market.

Unfortunately, too, tenants are not always careful about rented houses, so it is wise to avoid delicate or easily damaged materials and decoration.

REMODELING TO SELL. People interested in buying a remodeled house are likely to look first at bathrooms and kitchen, natural light, basement, attic, mechanical equipment and its state of repair, number of rooms, privacy, and condition of house and decoration. Most of them will be impressed by modern bathrooms and kitchen, good flooring, and a pleasing and well painted exterior.

Therefore if you are remodeling for the purpose of selling, the effect should be even more conservative than for renting, because most people interested in purchasing a house are likely to be looking for a conservative design which they can later add to, or alter, to suit their own tastes.

FINANCIAL CONSIDERATIONS

Under the heading *Is Remodeling Worth While?* the outline and discussion of the financial items was based on the assumption that money for remodeling was available or arranged for. In the following pages, further ways and means of securing loans, the cost of financing, financing requirements, how to figure monthly payments and to estimate remodeling costs are discussed in order to point out the more important financial considerations, and to recommend procedures.

SOURCES OF LOANS FOR REMODELING. There are many sources of remodeling loans, some operating in conjunction with the Federal Housing Administration and some entirely independent. Typical sources of loans for remodeling are given in the following material:

Savings, Building, and Loan Associations. The savings, building, and loan associations were the earliest sources of remodeling loans. Usually they make such loans on a basis of repayment in three

Table 3. Schedule of Monthly Payments on \$1,000 Loan

Period of Repayment	Interest Rates Possible				
	4½%	4¾%	5%	5½%	6%
10 years	\$10.37	\$10.49	\$10.61	\$10.86	\$11.11
9 years	11.28	11.40	11.52	11.76	12.01
8 years	12.43	12.55	12.66	12.90	13.15
7 years	13.91	14.02	14.14	14.38	14.61
6 years	15.88	15.99	16.11	16.34	16.58
5 years	18.65	18.76	18.88	19.11	19.34
4 years	22.81	22.92	23.03	23.26	23.49
3 years	29.75	29.86	29.98	30.20	30.43

Courtesy of American Savings and Loan Association, Chicago, Ill.

to five or ten years, at the same rates of interest charged for entirely new houses. The rates are sometimes as low as 4½ per cent and run upward from that, depending on the prevailing interest rate in a given locality. In some states these associations are required by law to take a mortgage on the property. Usually, they will advance the full amount needed for remodeling, even if the house is already mortgaged, provided the lien on the place is not too high a percentage of the value of the house. If the mortgage is a reasonable amount of the property valuation, such associations will refinance the old mortgage from the present mortgage and advance the additional funds for remodeling purposes. The average loan made by such associations has been about \$1,000, but they make much larger as well as much smaller remodeling loans.

A repayment schedule of a typical remodeling loan is as shown in Table 3. This table gives the monthly repayment of principal, with interest required, to liquidate a \$1,000 loan.

Material Companies. Many material manufacturers have monthly payment plans for remodeling which provide loans up to \$2,500 to be repaid in 36 equal payments.

Table 4 lists all of the figures necessary to compute payments based on 12, 18, 24, 30, or 36 monthly installments on loans from \$60 to \$2,500. To illustrate the working of this plan, take for example a kitchen modernizing job. Suppose the cost of modernizing is estimated at \$250, and that monthly payments of \$10 or \$12 suit the budget of the borrower. From Table 4 we see that the loan can be repaid in 24 months at the rate of \$11.47 per month. Or, if smaller monthly

Table 4. Rate Chart—Monthly Payment Plan Offered by Materials Manufacturers for Repairs and Remodeling

*To Figure Larger Amounts than \$500.00, Simply Add the Proper Figures Together
Minimum Monthly Payment \$5.00*

Cash Price	12 Monthly Payments		18 Monthly Payments		24 Monthly Payments		30 Monthly Payments		36 Monthly Payments	
	Amount of Note	Amount of Each Payment	Amount of Note	Amount of Each Payment	Amount of Note	Amount of Each Payment	Amount of Note	Amount of Each Payment	Amount of Note	Amount of Each Payment
\$60.00	\$63.15	\$5.26								
70.00	73.68	6.14								
80.00	84.21	7.02								
90.00	94.73	7.90	\$96.92	\$5.38						
100.00	105.26	8.77	107.69	5.98						
110.00	115.79	9.65	118.46	6.58	\$121.13	\$5.05				
120.00	126.32	10.53	129.23	7.18	132.15	5.51				
130.00	136.84	11.40	140.00	7.78	143.16	5.97				
140.00	147.37	12.28	150.77	8.38	154.17	6.42	\$157.57	\$5.25		
150.00	157.89	13.16	161.54	8.97	165.18	6.88	168.83	5.63		
160.00	168.42	14.03	172.31	9.57	176.19	7.34	180.08	6.00	\$183.97	\$5.11
170.00	178.95	14.91	183.08	10.17	187.21	7.80	191.34	6.38	195.47	5.43
180.00	189.47	15.79	193.85	10.77	198.22	8.26	202.59	6.75	206.96	5.75
190.00	200.00	16.67	204.62	11.37	209.23	8.72	213.85	7.13	218.46	6.07
200.00	210.53	17.54	215.38	11.97	220.24	9.18	225.10	7.50	229.96	6.39
210.00	221.05	18.42	226.15	12.56	231.26	9.63	236.36	7.88	241.47	6.71
220.00	231.58	19.30	236.92	13.16	242.27	10.09	247.61	8.25	252.96	7.03
230.00	242.11	20.17	247.69	13.76	253.28	10.55	258.87	8.63	264.45	7.35
240.00	252.63	21.05	258.46	14.36	264.29	11.01	270.12	9.00	275.95	7.67
250.00	263.16	21.93	269.23	14.96	275.30	11.47	281.38	9.38	287.45	7.98
260.00	273.68	22.81	280.00	15.56	286.32	11.93	292.63	9.75	298.95	8.30
270.00	284.21	23.68	290.77	16.15	297.33	12.39	303.89	10.13	310.45	8.62
280.00	294.74	24.56	301.54	16.75	308.34	12.85	315.14	10.50	321.94	8.94
290.00	305.26	25.44	312.31	17.35	319.35	13.30	326.40	10.88	333.44	9.26
300.00	315.79	26.31	323.08	17.95	330.36	13.76	337.65	11.26	344.94	9.58
310.00	326.32	27.19	333.85	18.55	341.38	14.22	348.91	11.63	356.44	9.90
320.00	336.84	28.07	344.62	19.15	352.39	14.68	360.16	12.01	367.94	10.22
330.00	347.37	28.95	355.38	19.74	363.40	15.14	371.42	12.38	379.43	10.54
340.00	357.89	29.82	366.15	20.34	374.41	15.60	382.67	12.76	390.93	10.86
350.00	368.42	30.70	376.92	20.94	385.43	16.06	393.93	13.13	402.43	11.18
360.00	378.95	31.58	387.69	21.54	396.44	16.52	405.18	13.51	413.93	11.50
370.00	389.47	32.45	398.46	22.14	407.45	16.97	416.44	13.88	425.43	11.82
380.00	400.00	33.33	409.23	22.74	418.46	17.43	427.69	14.26	436.92	12.14
390.00	410.53	34.21	420.00	23.33	429.47	17.89	438.95	14.63	448.42	12.46
400.00	421.05	35.09	430.77	23.93	440.49	18.35	450.20	15.01	459.92	12.78
410.00	431.58	35.96	441.54	24.53	451.50	18.81	461.46	15.38	471.42	13.10
420.00	442.11	36.84	452.31	25.13	462.51	19.27	472.71	15.76	482.92	13.41
430.00	452.63	37.72	463.07	25.73	473.52	19.73	483.97	16.13	494.41	13.73
440.00	463.16	38.60	473.85	26.33	484.53	20.19	495.22	16.51	505.91	14.05
450.00	473.68	39.47	484.62	26.92	495.55	20.64	506.48	16.88	517.41	14.37
460.00	484.21	40.35	495.38	27.52	506.56	21.10	517.73	17.26	528.91	14.69
470.00	494.74	41.23	506.15	28.12	517.57	21.56	528.99	17.63	540.41	15.01
480.00	505.26	42.10	516.92	28.72	528.58	22.02	540.24	18.01	551.90	15.33
490.00	515.79	42.98	527.69	29.32	539.60	22.48	551.50	18.38	563.40	15.65
500.00	526.32	43.86	538.46	29.91	550.61	22.94	562.75	18.76	574.90	15.97

Courtesy of U. S. Gypsum Company, Chicago, Ill.

payments are desired, the loan can be repaid in 36 months at the rate of \$7.98 per month. No down payment is required. Complete details of this plan can be secured from material dealers all over the country.

Insurance Companies. More and more insurance companies are

now offering money for building purposes. In general the details are handled through brokers from whom all the details may be secured.

Banks. Banks of all types such as Commercial, Savings, Mutuals, and others generally are interested in sound home loans. Detailed information relative to remodeling loans can be secured from any such bank.

Individuals. Private individuals often are anxious to invest in remodeling loans as a means of employing their idle capital. Attractive interest rates sometimes can be obtained from such a source.

In seeking a loan for remodeling from any lending institution, you must expect a careful investigation of your financial and personal affairs. Such a practice is fair and does not constitute an out-of-the-ordinary business procedure. The following rating chart is typical of considerations that decide how good a risk any borrower is.

Feature	Percentage Value
Character	30
Attitude toward obligation	15
Ability to pay	25
Future prospects	15
Business history	10
Associates	5
Total	100

Mortgages. There are two types of mortgages worth considering: straight-term mortgages and amortizing (automatically reducing) mortgages.

The straight type runs for a definite period, after which it becomes due and payable. It must then be paid entirely, or application made for a renewal, which may or may not involve the repayment of part of the remaining principal.

The advantage of the automatically reducing mortgage is that it is paid in regular installments, which is a help in setting up some systematic plan for paying it.

Unless you are unusually familiar with real estate values in your community, you should have expert advice from an appraiser or from an executive of a lending institution as to the proper procedure to

follow in securing a loan, and the amount you should go into debt in order to remodel your house. Many of the items which were outlined under *Is Remodeling Worth While?* as well as those which are discussed in the following pages, are essential for making a wise decision. A careful study of these, plus expert advice, is highly recommended. The details involved in obtaining a loan change from time to time, and for this reason only generalities have been discussed in this section. However, after careful consideration of the items given, and with expert advice, you will be able to judge whether or not the advantages are likely to justify the cost of your remodeling. It would be wise to obtain as much information as possible, relative to financial matters, before any actual work is done on the remodeling plans.

FINANCING REQUIREMENTS. The Federal Housing Administration, and the various lending institutions, have certain definite requirements which any property must meet before loans will be made for remodeling. They will outline such requirements upon application. The items listed under *Is Remodeling Worth While?* are typical.

HOW LARGE SHOULD MONTHLY PAYMENTS BE? The size of monthly payments for any remodeling work should conform to the borrower's ability to meet the payments with reasonable sureness, month after month.

If the house you plan to remodel is entirely paid for, then the regular yearly expense consists of taxes, special assessments, insurance, and maintenance costs. It is possible to estimate such items for years in advance with reasonable accuracy. Along with such regular expenses, the added amount of monthly payments for remodeling which you can be reasonably sure of meeting should be determined—in about the same way you would determine the amount of rent you could afford to pay.

If the house is already mortgaged, on the other hand, the remodeling payments must be added to the existing payments on the mortgage. The sum of these, plus the regular expense, determine what your total monthly payment will be.

If the house you plan to remodel is rented out on a regular yearly lease, the income from rent should at least be sufficient to cover the regular expenses plus the remodeling payments. For remodeling to be profitable, there should be a certain amount left over each month after the payments are made.

To avoid trouble and loss, it is well to record carefully all the items listed in the foregoing explanation, and make reasonably sure that you can meet the monthly payments.

ESTIMATING REMODELING COSTS. The allowable cost for remodeling depends on two general considerations. First, of course, are the items outlined under *Is Remodeling Worth While?* These and similar considerations, which are reflected in the requirements of all lending institutions, constitute a sound basis for determining allowable remodeling costs. Second, your financial status determines the amount that you should spend for remodeling. The decision as to the total allowable cost must in fact precede all preliminary thinking and also the actual planning of your remodeling job, as mentioned in a previous section.

When the remodeling requirements are definitely determined, and careful preliminary thought has been given to all the other items involved in your remodeling job, the actual planning can begin.

PROFESSIONAL PLANNING. If you are an architect or a tradesman thoroughly familiar with all the aspects of building, your training, experience, and knowledge of material and labor costs (as well as the knowledge of those associated with you in the work) will help you make plans for remodeling which will follow the requirements as closely as possible without exceeding the allowed total cost. In all probability you will want to make several checks as the plans progress, and in this check of estimates you may find it necessary to omit one or more of the originally stated requirements, if the allowable total cost is exceeded by their inclusion. In this way the plans and specifications would be finally completed within the allowable cost, after which final arrangements may be made with the lending institution, material dealers, and mechanics.

OWNER PLANNING. If you are not familiar with all the aspects of building, but want, nevertheless, to make the plans for remodeling, there are two ways of estimating the costs. First, you may select a general contractor and work in close cooperation with him. Second, you may carry on the planning alone, and then wait until the bids on your plans disclose what the cost of the work will be.

Working in cooperation with the contractor means that plans may be discussed before they have progressed very far, and a fairly accurate idea as to cost may be arrived at. A contractor who has had

considerable experience in remodeling should be able to judge the costs of any proposed remodeling work, as soon as the plans are far enough along to present a complete picture of the work.

Several conferences with your contractor, while plans are being worked out, will help make sure that final plans for your remodeling will come well within the allowable cost. If you intend to do your own planning, the selection of the contractor, and frequent conferences with him while plans are being made, are important from the standpoint of keeping the work within allowable costs.

If you do not know any contractor well enough to entrust the cost estimating to him, you may complete your plans, with the specifications, and then give a set of each to two or more general contractors, for bids.

If all the bids you receive are above the allowable costs, this means that you will have to do some further work on the plans, possibly eliminating some of the less important remodeling requirements. After the plans are thus changed, you may ask for new bids; this process to be repeated until the figures submitted come within the allowable cost.

It may be that one or more of the contractors who bid on the job may be willing to talk the plans over with you, and to offer suggestions as to what may be omitted in order to reduce the cost.

You may wish to ask contractors to submit bids which are broken down, also, so that the costs of carpentry, plumbing, electrical work, materials, and other items are listed individually. Such estimates are a great help in revising plans.

When it is necessary to reduce costs, it may be advisable to omit temporarily some of the original requirements, and to plan on carrying these out in the future, as financial considerations permit. Many programs of remodeling might easily be adapted to two or more installments. If you are planning to remodel a house for your own use, rather than to rent or sell it, piecemeal remodeling is often a practical solution.

To illustrate, turn to Figs. 74A and 74B. If the cost of this remodeling job had been too much for the owner's budget, the changes and additions to the main part of the house could have been completed first, and the porch and garage could have waited for a time when they could be added without financial stress.

CHAPTER V

How to Select Architectural Types for Complete Remodeling

IN CHAPTER IV it was pointed out that in the preliminary thinking, preceding any actual work on remodeling plans, the selection of architectural type is one of the first items to be considered.

It is a mistake to think about the remodeling or addition of rooms, or any other proposed changes, before the architectural type has been carefully chosen. The positions of rooms, windows, doors, entrance, chimneys, dormers—indeed all the details of remodeling—depend almost entirely on the architectural style, as was pointed out in Chapter I. Once you have decided upon the type, everything else can be planned in proper relation to it.

There are many factors involved in choosing the architectural type to use in any remodeling job. It is the purpose of this chapter to explain these factors in such a manner as to give you a definite procedure to follow, so that you will avoid omission of any important consideration.

NEIGHBORHOOD. The neighborhood in which an old house is situated is an important consideration in the selection of the architectural type to use in remodeling, for the following reasons:

If the majority of the houses in the immediate vicinity are of a rather superior class and good modern design, then, in fairness to the other home owners, you should select a style that will conform in quality and appearance with the other houses.

If the other houses are of a type such as Cape Cod or English Colonial, you might well select the same type. To do otherwise would make your house stand out too conspicuously. Also it would detract somewhat from the charm of the other houses, and from the general appear-



ance of the entire vicinity. Since all the houses, collectively, make any community either desirable or undesirable, no individual should be thoughtless enough to detract needlessly from the appearance of a group of houses.

In many neighborhoods no two houses are of the same general type of architecture. In this case you are free to decide upon practically any type which your taste and other considerations may dictate. Even here, however, the type selected should not be so radical that it will make your house contrast too sharply with its neighbors. Good conservative types are best, because they appeal to the largest number of people and heighten the possibility of renting or selling, if this should ever be desired. In a neighborhood composed of Cape Cod, English Colonial, Dutch Colonial, and other common types, it would not be wise to select a Southern Colonial or Georgian type of architecture for remodeling.

In most residential neighborhoods, the various Colonial types of architecture blend best with the surroundings, especially where the lots are small and houses are close together.

Where lots are very large you have a wider choice of architectural types, because houses are far enough apart so that conflicts in types are not noticeable. If a city block, for example, is divided so that each lot is at least 100 feet wide, then the houses on these lots can be designed and treated individually, rather than in terms of the entire community.

In the poorer neighborhoods, where most of the houses are inexpensive, poorly designed, and poorly maintained, there would be a question as to the advisability of remodeling at all. However, if you did have sufficient reason for remodeling, then architectural type need not be so carefully selected. In fact, in a neighborhood of this kind, considerable expense might be saved by not attempting to conform to any particular type of architecture, since any remodeled house, even one of no particular type, would be a decided improvement in such surroundings. The thought and expense involved in creating a perfect architectural type in a poorer class neighborhood would be wasted, unless for some special reason you wish to remain in the community and at the same time live in a completely modern, well designed house. The renting and sales possibilities would not warrant the expense of good design.

In many small towns or older residential neighborhoods, there are streets where all of the houses are of considerable age, with old-style porches or verandahs, an endless amount of ornamentation and "gingerbread," long narrow windows, high roofs, and other characteristics of design practices long since out of fashion. The complete modernizing of a house in such surroundings would not greatly improve its value, and at the same time would make it so conspicuous as to be an embarrassment to you. Furthermore, it would effect the appearance of the whole community. In a neighborhood of this kind, *partial remodeling*, explained in Chapter IV, is recommended. By this means the interior could be radically altered, with but little change in the exterior appearance. You would thus enjoy the benefits of modern design inside your house, without making exterior changes not in accord with the community.

The remodeling job shown in the blueprints in the back of this book was planned to follow this procedure. The interior was extensively remodeled, whereas the exterior was not radically changed, so that it would still blend with the other houses of the neighborhood.

Architectural fashions, like other styles, change during periods of from twenty to thirty years. The houses built thirty years ago are now, for the most part, called old fashioned. Occasionally you may see an old house which does not appear old fashioned, or out of style. A study of the design of such a house will reveal that it is simple and conservative. From this it follows that if you will select a simple and conservative type for remodeling today, your house will not appear so old fashioned, or out of style, in the years to come. The Cape Cod and Colonial types lend themselves best of all, perhaps, to simple and conservative design.

SHAPE AND GENERAL CONDITION OF OLD HOUSE. Cost is usually an important factor in remodeling work, and therefore you must give some preliminary thought to keeping costs from mounting above a definite limit. To do this and still obtain desirable results in remodeling, the type of architecture selected must be one that can be followed without a great deal of actual structural change in the old house.

Suppose, for example, that the house shown in Fig. 83A were to be remodeled. Further suppose that other houses in the neighborhood were generally Colonial in type. Fig. 83A shows the house to be

rectangular shaped. To remodel the exterior as cheaply as possible, and still obtain desirable results in keeping with the better houses near by, the type of architecture should be one that features a rectangular shape.

In Chapter I you learned that Colonial houses are rectangular in shape. Therefore, if a Colonial type is selected for remodeling the house shown in Fig. 83A, it will not require as much structural change as though some other type were chosen. Fig. 83B shows this



Fig. 83A. Typical Old-Style Rectangular-Shaped House
Courtesy of Curtis Companies, Inc., Clinton, Iowa

same house after remodeling. You will note that without much structural change, a distinct Colonial atmosphere has been achieved. Thus Figs. 83A and 83B illustrate the value of selecting an architectural type which can be achieved without too great expense.

Figs. 84A and 84B illustrate how an old-style rectangular house having a wing was remodeled to conform to the Colonial type without a great amount of structural change. In this case the Colonial type was selected precisely because of the few changes that would be

required in the old structure to create an authentic Colonial atmosphere through remodeling.

Once you become thoroughly familiar with the commonly used architectural types described in Chapter I, you can, by careful preliminary thinking, select a type nearly enough like your old house to avoid excessive remodeling costs.

You may select an architectural type with the idea of making a remodeled house *nearly* like it; or in other words, including enough



Fig. 83B. House Shown in Fig. 83A, After Remodeling
Courtesy of Curtis Companies, Inc., Clinton, Iowa

characteristics of a certain type to give the remodeled house at least the atmosphere, or effect, of the pure type. This procedure is often followed, as in the houses illustrated in Figs. 83 and 84, with pleasing results and without the increased costs involved in structural changes.

The existing walls and partitions, stairways and supporting members in the old house should be considered in your preliminary thinking. In many cases their omission, in order to accomplish certain desired results through remodeling, necessitates rather costly structural work. A bearing partition, for example, can seldom be



Fig. 84A. Typical Old-Style Rectangular Shaped House Having a Wing
Courtesy of Curtis Companies, Inc., Clinton, Iowa

removed without providing some other means of supporting the floor loads it was designed to carry. There are various kinds of beams which can sometimes be used in place of bearing partitions, if there are



Fig. 84B. House Shown in Fig. 84A, After Remodeling
Courtesy of Curtis Companies, Inc., Clinton, Iowa

ample means of supporting both ends of such beams. Sometimes, however, the supporting of such beam ends is impossible without costly structural work.

The location of stairs in an old house is an important consideration, because if possible the same location should be planned in the remodeling. Building stairs in new locations adds a great deal to remodeling costs.

Old chimneys should be carefully considered and, if possible, made use of in the remodeling, because they, too, are very costly to rebuild.

Roofs should be given most careful thought in the selection of architectural types, because to rebuild a roof entirely requires large amounts of labor and materials. Roofs may be altered or extended, as in Figs. 84B and 85B, to create the atmosphere of a certain architectural type, at a reasonable cost.

In general, your preliminary thought should include a careful analysis of all the existing members of your old house, in order that the architectural type selected does not create structural problems which are difficult and costly to solve.

If your remodeling requirements call for additional rooms, wings, or garage, the architectural type must be selected so that as these additions are made, the resulting structure will conform to the characteristics of the type. Otherwise, the additions will cause an unbalance in the structure which is not only costly, but in many instances impossible, to correct.

All cities, towns, and villages have certain codes or laws in relation to buildings. It is possible that one or more items in such laws might conflict with certain structural features of the various architectural types. You are therefore, advised to study the existing building laws, and to make sure that the type of architecture you select will not require unlawful details of construction.

ARCHITECTURAL TYPES IN RELATION TO ALLOWABLE COSTS.

Careful consideration must be given to the shapes, ornamentation, materials, and labor required for the various types of architecture, in relation to allowable costs. Some of these items are discussed here, as a guide in your preliminary thinking.

Wing Types. In this type the house may be either square or rectangular in shape, with the addition of one or two wings. Wings

add very pleasing detail to a house. However, in remodeling they are likely to cost a great deal more than the cost of adding the required rooms in what was formerly attic space, or even than extending one end or side of the old house.

Every room added to a house in the form of a wing must have foundation, exterior walls, and roof. If the rooms added by these wings are to be at all large, many linear feet of foundation and walls, and many square feet of roofing, will be necessary. On the other hand, two or more rooms may be added by extending one end of a



Fig. 85A. Typical Old House Before Remodeling
Courtesy of U. S. Gypsum Company, Chicago, Ill.

house, without requiring nearly so much new foundation, walls or roof. Thus, your choice of which way to add the required rooms, and consequently the choice of architectural type, depends on your allowable cost for the remodeling work.

Example. Figs. 85A and 85B show an exterior view and floor plan for a typical old and run-down house. Figs. 86A and 86B show the same house after remodeling.

In this instance the owner wanted to add some rooms, as well as to improve the shabby appearance of the exterior. The costs had to be kept below a definite figure.

At first the owner contemplated the addition of the required rooms by wings, but because of the fact that their use would have exceeded his allowable costs, he decided to build on the rooms by the less expensive addition at the back of the house.

His preliminary thinking first contemplated the addition of two wings, one at each side of the house. Then he considered building one large wing only. However, both of the wing plans meant many linear feet of foundation and outside walls, many square feet of flooring, plastering, and roofing. Either would have brought the costs far above his allowance for them.

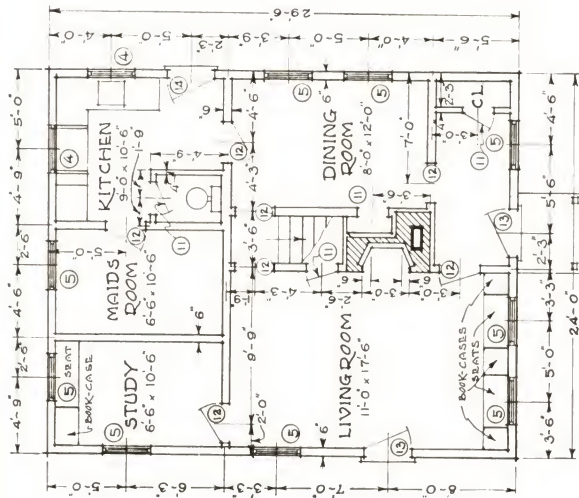


Fig. 86A. House Shown in Fig. 85A, After Remodeling
Courtesy of U. S. Gypsum Company, Chicago, Ill.

The final idea was to extend the back part of the house a distance of about 11', as shown in Fig. 86B. This made possible the addition of a study and a maid's room, and a larger kitchen on the first floor, as well as enlarged rooms on the second floor. The use of a dormer on the rear further reduced costs.

This final idea, while not as impressive as the ideas involving the use of wings, provided for all the requirements at reasonable costs. This example illustrates further the careful preliminary thinking that is required in the selection of architectural types.

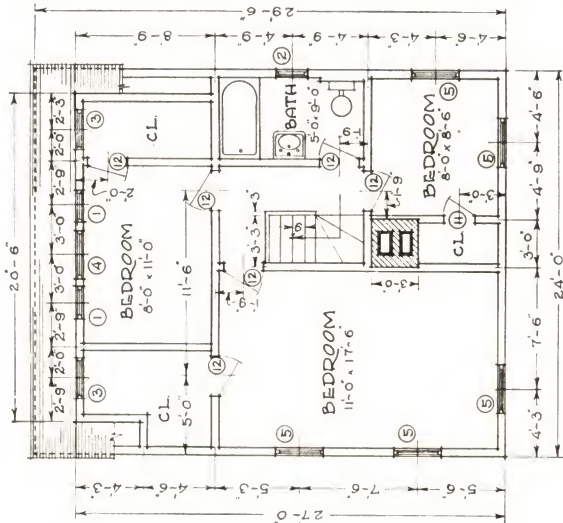
One-Story Type. To a one-story house, wings or ells can be added with pleasing results. However, as explained under *Wing Types*,



FIRST FLOOR PLAN

SECOND FLOOR PLAN

Fig. 86B. Floor Plans for House Shown in Fig. 86A
Courtesy of U.S. Gypsum Company, Chicago, Ill.



WINDOW SCHEDULE	
①	DOUBLE HUNG 2'-0" x 4'-6" 12 LTS
②	DOUBLE HUNG 2'-0" x 4'-0" 2 LIGHTS-GLAZED GLASS
③	DOUBLE HUNG 2'-6" x 3'-6" 12 LTS
④	DOUBLE HUNG 3'-0" x 4'-6" 12 LTS
⑤	DOUBLE HUNG 3'-0" x 5'-2" 12 LTS
⑥	

DOOR SCHEDULE	
⑩	1'-8" x 6'-6"
⑪	2'-0" x 6'-6"
⑫	2'-6" x 6'-6"
⑬	3'-0" x 7'-0"
⑭	3'-0" x 6'-6"
⑮	

wings and ells are apt to exceed allowable cost. In most cases one-story houses have attic areas which, by the use of dormers, can be transformed into one or more rooms at much less expense. The selection of a Cape Cod type, for example, will in most cases satisfy the requirement of extra rooms, improved appearance, and reasonable cost, by converting a one-story house into the popular story-and-a-half type.

Story-and-a-Half Type. In remodeling a story and a half in order to create more space, there are several types of architecture to choose from and several ways to obtain the desired results. The addition of wings or ells is often possible with pleasing results but at considerable cost. Another way would be to select a Colonial type, such as Dutch Colonial, which would require raising the roof and possibly adding more dormers. This idea would eliminate the waste space often found in story-and-a-half houses near the eaves, allowing more room on the full sized second floor. Or, you might select the English Colonial type of architecture, by which a full second floor, with its flat ceilings and attic space, could be achieved.

ARCHITECTURAL TYPES IN RELATION TO LIVING SPACE. Many beautiful houses use a great deal of space for halls, stairs, and reception halls, or contain waste space near the eaves, none of which can be called living space. Only actual rooms can be called living space. Such waste space adds unnecessarily to the costs. In remodeling, if your budget is limited, you should avoid space which is not livable wherever possible.

Rectangular Houses of a Story and a Half. In houses which are a story and a half high, considerable waste area is frequently found near the eaves. Fig. 87 shows a section of a typical story and a half with a dormer *FGH*. The knee walls *BF* and *CE* form the sides of the room or rooms on the second floor, whereas *GHJE* forms the ceiling.

The areas *AB* and *CD*, between the knee walls and the eaves, are waste spaces. While such spaces may have limited use for storage, they are the weak points of a story-and-a-half house.

Two-Story Rectangular Houses. A full two-story house has little waste space, unless we think of the attic as such. However, since any type of house must have a roof, the consequent attic space is unavoidable. Even so, the pitch can be low and some saving made in that

manner. In general, two-story types have less waste space than the story and a half, and in addition they do not have the handicap of the sloping ceiling.

Halls and Stairs in Rectangular Houses. A rectangular shaped house of one, one and a half, or two stories requires less hall and stair space than any other type. This is because all rooms can be arranged around a small central hall on one or both floors. In houses having wings and ells the amount of space required for halls increases considerably, and where the wings or ells are long, additional stairways are necessary.

ARCHITECTURAL TYPES ON NARROW OR WIDE LOTS. Your selection of architectural type depends also on the width of your lot,

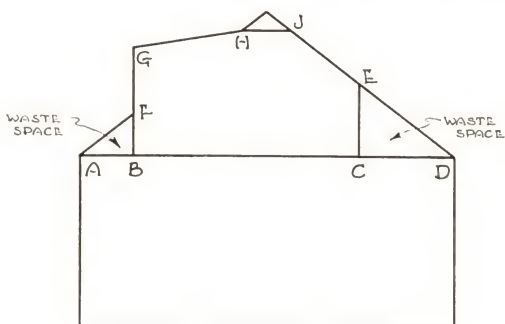


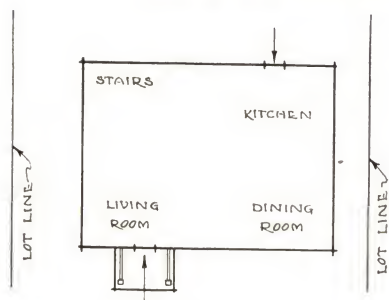
Fig. 87. Section View of Typical Story-and-a-Half House, Showing Dormer and Waste Space

because a house suitable for a wide lot would look cramped, and might be impossible structurally, on a narrow lot. Many city lots are only 40' wide, and are designated as narrow lots. A lot from 40' to 100' or more in width is called a wide lot.

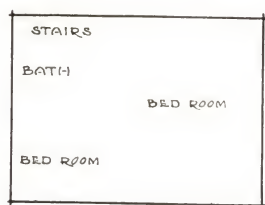
Narrow Lots. For narrow lots, houses that are rectangular in shape are best, because if necessary the main entrance can be placed on the side, unless the more expensive wing and ell types can be considered.

Example. Suppose an old house has floor plans something like Fig. 88, and that the lot is narrow, as shown by the lot lines. The owner desires more rooms and a garage.

Additions to this house could be made by selecting an English Colonial type with some deviations. Fig. 89 shows how the remodel-

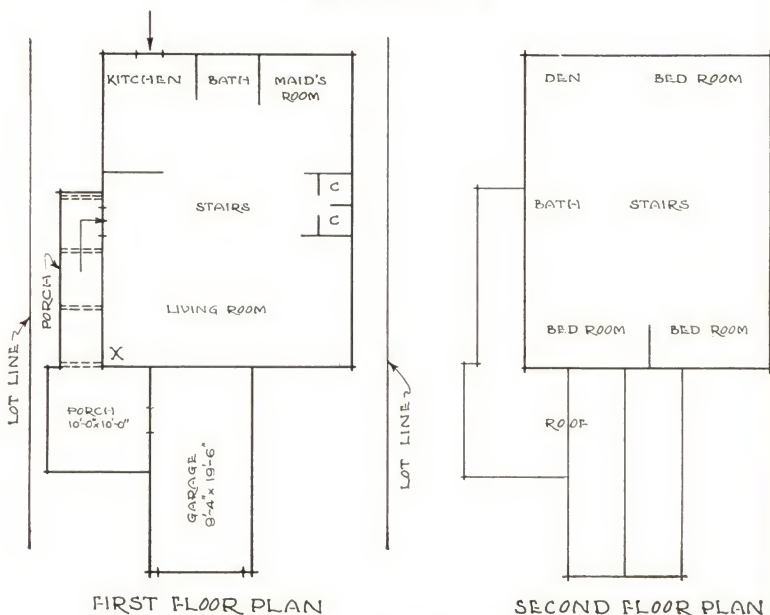


FIRST FLOOR PLAN



SECOND FLOOR PLAN

Fig. 88. Outlines for a Typical Small House on a Narrow Lot



FIRST FLOOR PLAN

SECOND FLOOR PLAN

Fig. 89. House Shown in Fig. 88, After Remodeling

ing could lengthen the house toward the rear, change the entrance to the side—in order to maintain the Colonial tradition of having the entrance near center on the long side of the house—and add a garage in front. If further modification of the Colonial type were not objectionable, the entrance could be placed at X in the first-floor plan of Fig. 89.

The interior remodeling shown in Fig. 89 has added a maid's room, a bedroom, a den, and a first-floor bathroom, besides enlarging the living room.

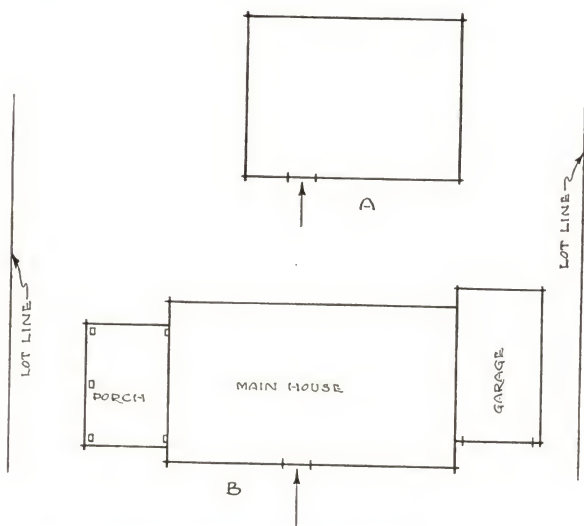


Fig. 90. Small House Enlarged to Look Imposing on a Wide Lot

This example shows how a house can be made much larger, even on a narrow lot. Careful preliminary thinking will convince you that any of the Cape Cod and Colonial types can be handled in about the same manner.

Rambling houses, with wings and ells, can be put on a narrow lot if you care to have a long house. This, however, is not ordinarily considered good practice.

Wide Lots. Wide lots do not restrict the selection of architectural types in any way; practically any type can be selected. For example, refer to Fig. 83B. Here the remodeling employed a wing of considerable length to add a garage and porch. All Colonial types work out

very well on wide lots. Old rectangular shaped houses, having their long dimension parallel to the street, may have both ends extended to give more interior space, and to conform to the Colonial type.

Sometimes wide lots have little depth, in which case the Colonial type fits especially well on the lot. Or, as far as the lot is concerned, a rambling house with wings or ells can be selected to good advantage.

Example. At *A* in Fig. 90 a rectangle represents an old house which we assume to be just off the center line on a wide lot. We assume that the owner wants to remodel in order to have additional rooms, a garage, and a porch.

At *B* in Fig. 90 an enlarged rectangle shows how the left end of the house could be extended in order to make more room in the main house, and how a porch and garage could be attached to the ends of the remodeled house, to give it an imposing appearance.

This sort of remodeling job makes use of a Colonial type of architecture with excellent results.

An advantage of this plan is that if desirable, the main house can be remodeled first, and the porch and garage added a year or so later, as finances permit.

MISCELLANEOUS CONSIDERATIONS. A few miscellaneous items that you must consider also, are presented in the following paragraphs. They are typical, and should guide your further preliminary thinking in the matter of selecting the type of architecture to use for your remodeling:

A square house is the most economical form in which a given amount of space can be enclosed.

A low pitched roof costs less than a high one. A roof without dormers costs less than one with dormers.

An inside chimney costs less to build than a decorative one on the exterior.

Fewer outside corners make the cost of the house lower.

A rectangular shaped house is cheaper than one with wings or ells.

An elaborate exterior cornice requires expensive material and a great deal of labor.

Lumber construction generally produces lowest cost remodeling.

Bay windows are beautiful but their cost is double that of ordinary windows.

Architectural types which can use standard millwork are the cheapest. Special millwork adds greatly to remodeling costs.

Architectural types which can use standard doors and windows are the cheapest. Special doors or windows cost much more.

Architectural types where cheap siding and shingles may be used as exterior surfacing are much less costly.

Architectural types not requiring an exterior chimney are cheaper because an interior chimney can be used for both fireplaces and furnaces.

A two-story house requires less basement and roofing than a one-story house, in proportion to the amount of living space provided.

Select architectural types which do not require much exterior trim because this is expensive. Types may be selected whose general proportions add all the beauty required without resorting to costly fretwork (ornaments).

Remember that good conservative types appeal to the greatest number of people.

Remember that lending institutions favor architectural types which are most likely to endure for many years to come and that they frown on highly ornamental or flashy types.

The difference in the costs of remodeling is more often due to the architectural type selected than to the living space involved.

The key to genuinely low-cost remodeling is the selection of an appropriate type, an efficient floor plan, and a minimum of time-consuming and expensive details.

A fairly large remodeling job, using durable but inexpensive materials and conservative construction, can be carried on at less cost than an elaborately planned small job where expensive materials and costly construction are required.

Plan on providing a good conservative house, from the shelter, rather than from the gadget, standpoint. Plan for the body of the house first, and then add special features as finances permit.

All change of mind should be made before remodeling begins. After work is under way, any change will cost a great deal.

Make a list of everything you want in a remodeling job, as far as appearance goes. Then select the type of architecture which best satisfies this list without, at the same time, violating either the costs or any other necessary consideration.

If remodeling to be done now is only part of a larger remodeling plan, be sure to select a type of architecture which will be correct for all future changes as well.

Remember that a flashy architectural type *dates* a house. Simple traditional types are ageless.

Remember that it is always easier to make an exterior type fit the interior requirements, than it is to make your interior fit the exterior of an architectural type that is not wisely chosen.

SUMMARY. A first reading of this chapter might give the impression that, with so many items to consider, the selection of an architectural type is very difficult, and should be left to the judgment of an expert with a great deal of experience. However, a little more study and thought will convince you that all the items can be considered easily, in logical order, and with effective results.

Certainly you have a definite idea as to the purpose you wish to accomplish, or requirements you wish to meet by remodeling. Your family may be increasing, and you need more rooms; your present house may be somewhat antiquated in exterior and interior appearance, and you may wish to give it a modern treatment; you may want to make the house more desirable from a renting standpoint; or you may be planning to make such improvements as will enable you to sell the house profitably. Whatever your reason for remodeling, the process of selecting the architectural type is carried on in the same way.

A careful study of this chapter will fix most of the important items in your mind. You need not try to memorize them, however, but rather use the chapter as a checklist.

Assume that you have an old house, and that you have applied the checklists in Chapter IV and found that remodeling will be worth while. Your next step would be to outline your requirements, also in accordance with checklists given in Chapter IV. With this information actually in writing, supplemented by sketches, perhaps, the selection of an architectural type is simply a process of checking the requirements against the advantages, disadvantages, economies, expense and other factors involved in each architectural type, as listed in this chapter. If you prefer a certain architectural type to begin with, you may check its feasibility, item by item, against the explanations in this chapter. If you have no particular preference, use these explanations as a means of selecting the best type.

CHAPTER VI

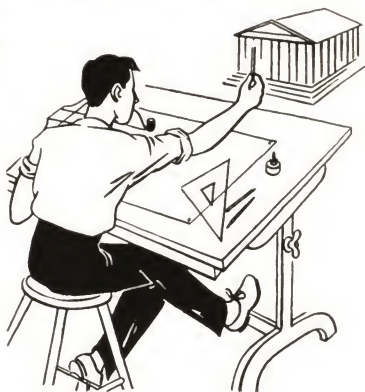
Architectural Drawings

THROUGH the process of preliminary thinking outlined in Chapters IV and V, you now should be able to visualize, or form a complete mental picture of, your remodeling job. In other words, when your preliminary thinking is completed, an image of the actual remodeled house, with all its changes or additions, should be clearly visible to you. This is absolutely necessary before the next step in planning can be taken.

However, mental pictures at best are somewhat incomplete, and certainly they fail to take into consideration many items of a structural nature. Furthermore it would be very difficult for you to make up an actual list of materials, or to estimate labor costs, from them.

Another lack in your mental picture is that you cannot show it to anyone else. No matter how clear an image you have formed of your remodeling job, you would have some trouble attempting to explain it to your contractor or carpenter. You might convey some idea of the proposed alterations, but it is far too likely that the carpenter would miss one or two important details, or that he would form his own, and quite a different, picture of certain parts of your remodeling job, which could lead only to confusion, and probably to unsatisfactory results.

Therefore, to acquaint others with all the changes or additions involved in your remodeling job, and to bring about a precise understanding on every item, architectural drawings must be made which will show all the details, and exactly what constitutes your proposed job. Only by the use of such drawings can you eliminate all possibility of misunderstanding, and guarantee satisfactory final results.



The purpose of this chapter, then, is to show why architectural plans are necessary, the relation of the drawings to written specifications, when drawings are required, how to draw floor plans and elevations, and when to write specifications; also to give some hint as to the use of special types of drawings in the design work involved in remodeling.

WHY DRAWINGS ARE NECESSARY. In the following paragraphs, some of the important reasons for making architectural remodeling drawings are explained. These are important and should be considered seriously.

For Blueprints. The important part played by blueprints in remodeling work is explained in Chapter II. Blueprints are made from architectural drawings. Thus, before blueprints can be made and distributed, the drawings must be completed.

In Planning. In your preliminary thinking it is possible to acquire a fairly complete mental picture of all changes to be made, including new rooms and rearrangement of rooms. However, in order really to test the correctness of your ideas on these changes, drawings can be used to maximum advantage. In other words, after you have given considerable preliminary thought to a specific item, drawings of that item should be made; these will serve not only to test the correctness of your idea, but to picture the details of that item for everyone concerned.

You may have a mental picture of certain rooms, room arrangement, window locations, and other details which seem all right. Yet once this picture is actually drawn upon paper, certain flaws or defects may be seen. This process of actually drawing and testing specific items is called design, or planning.

When planning for remodeling you must consider many items, such as direction of joists, bearing partitions, beams, support columns, and load distribution. To plan these safely, scaled drawings are required as explained in several succeeding chapters.

Dimensions, material symbols, locations of various items, doors, windows, and like details must be noted and explained accurately for the benefit of carpenters and other mechanics. This is all part of actual planning, and can only be done by drawings.

At the beginning of this chapter it was stated that drawings were necessary to avoid confusion and misunderstanding between the

owner and the mechanics doing the remodeling work. Only by studying and understanding the drawings, can both be sure of having exactly the same idea of what is to be done. What is shown on a drawing (blueprint) does not change, and if the blueprints show exactly what the owner wants done, the mechanic cannot possibly have any wrong conceptions of the work.

Drawings protect the various contractors who agree to do the work, as well as the owner. Contractors base their estimates and contracts on the requirements shown on the drawings. Once work has started on the basis of the drawings, there can be no possibility of the owner changing his mind, or claiming that something not shown on the plans was included in the contract.

In like manner, the contractor cannot claim "extras" for items shown in the drawings, nor can he fail to carry out every detail that appears in them.

In Estimating. As explained in Chapter II, when remodeling of any appreciable amount is to be done, ordinarily the owner or his agent gives out sets of blueprints and specifications to various contractors for bidding.

Before a contractor can accurately estimate costs, he must have drawings which show every phase of the remodeling job. With the drawings he can make accurate surveys of the kinds and quantity of material and the amount of labor which will be required.

Asking contractors to bid on remodeling jobs for which there are no drawings is unfair to the contractor and a danger to the owner. Without drawings, a contractor must use guesswork in making his estimate. In such a case he is very likely to make his bid high, in order to be sure he will have enough money to pay his costs and make a profit.

For Contracts. Contracts are closely related to estimating, since they are based on estimates. Therefore, you can see that drawings are necessary in order that the owner may obtain the most desirable contracts possible. When contracts are based on drawings, owner and contractor alike are protected against misunderstandings, lawsuits and similar trouble.

In Financing. Many lending institutions require the submission of drawings for all remodeling jobs which they are asked to finance. The drawings, which present a complete picture of what is to be done,

are an aid in securing a loan, because the proposed improvements are easily seen and the whole job is put in a much more favorable light. Here again, drawings are a means of showing other people what constitutes a given remodeling job, and they do it much better than could be done in words.

RELATION OF DRAWINGS TO WRITTEN SPECIFICATIONS. As explained in Chapter III, written specifications are supplementary to, and explanations of, the blueprints. In other words they give a great deal of important information which could not be shown easily, if at all, on the blueprints. In remodeling work the drawings (blueprints) show the plans and elevations, plus all symbols and dimensions, while the specifications describe the work and specify as to materials, workmanship, and like details.

In remodeling work, specifications are even more important than for entirely new work, because of changes in windows and doors, rearranging, repairing, revising, partial use of old materials, and other problems peculiar to remodeling. These all require specific instructions which cannot be shown completely by symbols or brief notes on drawings. Specifications are the means of explaining remodeling plans in detail and are of great aid to the mechanics, as well as serving to put the proposed work in a favorable light when a loan is being sought.

It was explained how drawings serve as a check or test of the remodeling ideas. In like manner the specifications serve as a check or test for the drawings, because in them the work shown on the drawings must be described. If an idea is faulty, an attempt to explain it will often bring out the defect, and thus help avoid construction troubles.

WHEN DRAWINGS AND SPECIFICATIONS ARE REQUIRED. In most instances both drawings and specifications are required; in others, only specifications are necessary.

Complete Remodeling. When remodeling work comes within this division both drawings and specifications are required. The drawings should be complete in every detail, and the specifications should thoroughly explain every item not made absolutely clear on the drawings.

Partial Remodeling. In this classification the drawings should show all structural changes the same as for complete remodeling.

The specifications should explain the drawings and also all items of painting, decorating, and general repair. Items of work not shown on the plans should be thoroughly explained both as to the scope of the work and the kind and quality of materials and workmanship.

Modernizing. Generally this division does not include much actual structural work except installation of kitchen and other equipment, new entrance details, etc. If a great deal of rearranging, furring down of ceilings, and installation of new equipment is required, drawings should be made to show the exact position of each item of equipment and any related structural changes. The specifications should describe the work and state the kind and quality of materials.

Repairing. This remodeling classification does not include any structural work so only specifications are required. Every item of repair should be carefully described along with the kind, type, and quality of materials to be used. The explanations should be given in a detailed manner so that estimates of material and labor can be made with a minimum of error.

DRAWINGS REQUIRED FOR REMODELING. In Chapter III the drawing of two sets of plans for remodeling jobs was suggested—one set to show the old plans and elevations and one set to show the remodeled plans and elevations.

Old Plans and Elevations. Suppose you have the original blueprints for your old house. In this event the drawings should be checked to make sure that the house as it now stands is as indicated on the blueprints, in every detail. If it is, these blueprints may then be copied, or reproductions may be made from them by one of several photostatic processes which any blueprint-making establishment or drafting supply store can carry out. The method does not matter, just so several copies of the plans and elevations are made available.

Remodeled Plans and Elevations. The set of remodeling drawings should consist of plans and elevations complete in every detail. Have these reproduced as blueprints, ordering as many copies as you have of the original plans and elevations.

The blueprints in the back of the book show the old and new floor plans, and the original and new elevation views, as required for a typical remodeling job.

DRAFTING EQUIPMENT. To make good drawings, you will need to secure the following drafting equipment.

Instruments. The drafting instruments required include a drawing board, T square, at least one triangle, a three-sided scale, a compass, and 3H or 4H pencils.

Materials. Drawings from which blueprints are made are drawn on what is commonly called vellum paper. This material is a tough transparent paper on which pencil drawings may be made.

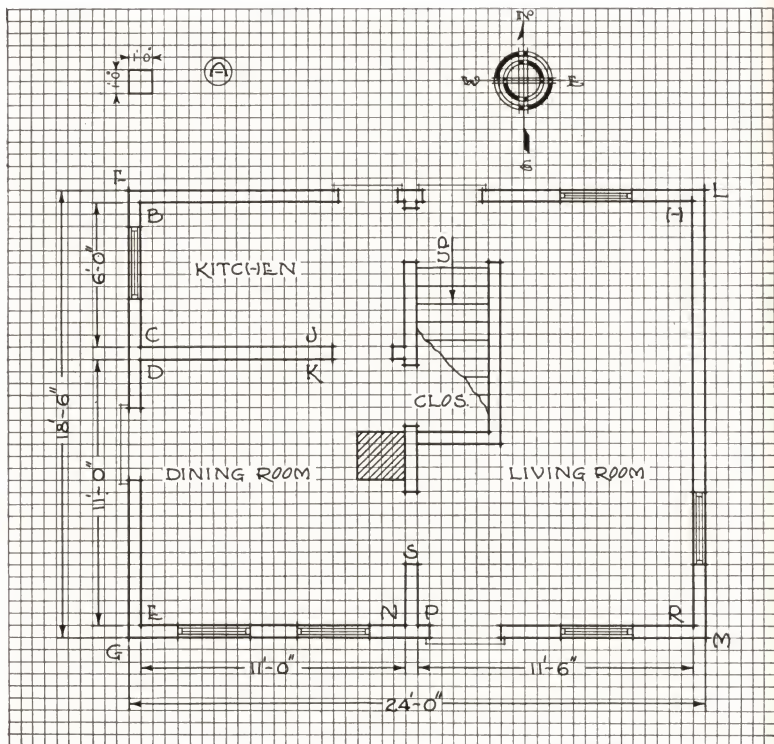


Fig. 91. Rough Drawing of Floor Plan on Graph Paper

All drafting equipment may be purchased from drafting supply concerns, stationery stores, or mail-order houses.

HOW TO DRAW FLOOR PLANS AND ELEVATIONS. The following directions cover circumstances that might arise in remodeling drawings.

Tracing Old Blueprints. If the original blueprints for your old house are available but for some reason cannot be reproduced by photostatic process, they can be traced as follows:

Tack a floor plan or elevation down to the drawing board so that the horizontal white lines will line up with the **T** square. Then tack a piece of vellum paper directly over the blueprint. Trace the blueprint on the vellum paper by drawing a pencil line for each white line on the blueprint. Do this for all plans and elevations. When the tracings are complete, you can send them to a blueprint-making concern and have any number of blueprints made from them.

Making Old Plans. If the old plans of your house are not avail-

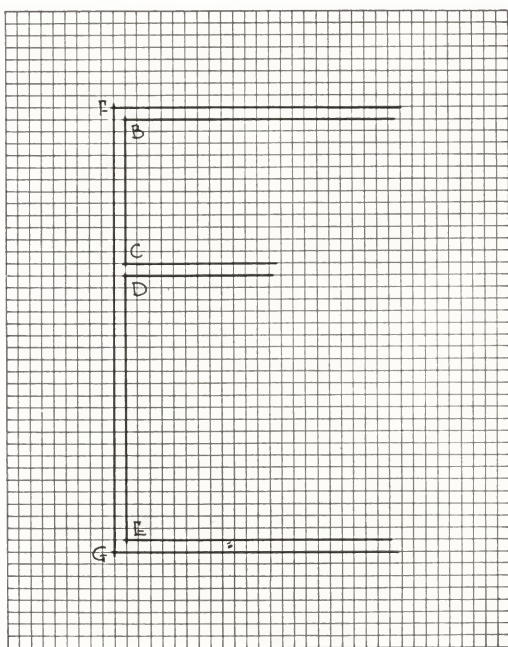


Fig. 92. Rough Drawing Partially Complete

able you will have to take actual measurements from your house and draw plans from them. An easy method is given in the following paragraphs.

FLOOR PLAN. Fig. 91 shows a rough floor plan drawn on graph paper. This paper can be secured at stationery stores, or the lines could be drawn on plain paper. You will observe that graph paper is composed of vertical and horizontal lines which make squares of various sizes. The square at *A* shows a typical size. For the purpose of drawing rough floor plans, consider that each such square represents one square foot. Tack a piece of such graph paper down to a drafting board, and begin drawing the plans for your present house. (A square,

south wall of living room. Assume it is 11'6", and count over $11\frac{1}{2}$ squares and mark point *R*. Then draw line *PR*. Draw line *GM* allowing 6" for wall thickness. Draw vertical lines of indefinite length upward from points *R* and *M*.

Next measure the short wall between *S* and *N*. Assume it is 2'6". From *N* draw a vertical line upward a distance of $2\frac{1}{2}$ squares. Then complete the short length of wall by drawing another line up from point *P*.

The rough drawing at this stage looks like Fig. 93. Draw the balance of the floor plan in the same manner. Measure and locate the stairways, closets, chimneys, partitions, and like details, by the same system of measuring and counting

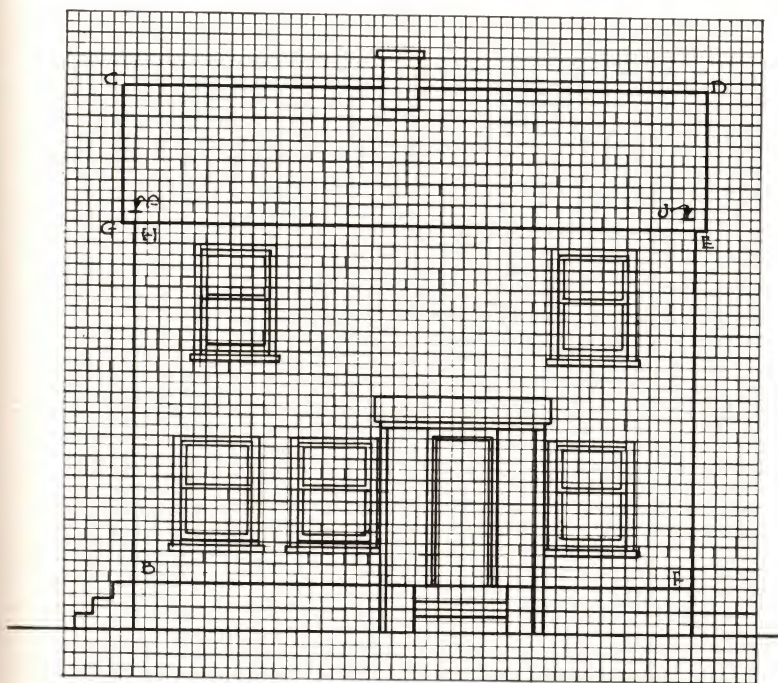


Fig. 94. Rough Drawing of Elevation View on Graph Paper

off squares. Fig. 91 thus represents the original first-floor plan. Draw basement and second and third floors in the same way.

Windows and doors are located and sized by measuring them and their locations on the old house, and then locating them on the rough drawing by means of the squares.

Making Working Drawings. Now that you have a rough, but scaled drawing, such as Fig. 91, you are ready to proceed with the working drawings, from which the blueprints are made. Put a large piece of vellum paper on the drafting board. Then draw the lines *FL*, *FG*, *GM*, and *M*, making sure that they are drawn accurately to some scale, such as $\frac{1}{4}" = 1'0"$. The length of the lines is found by counting squares in Fig. 91. Then draw lines representing the inside edges of the walls and be sure the wall thickness scales exactly six inches. Draw-

ing to scale was explained in Chapter II. Draw all partitions, using the dimensions obtained by counting squares in Fig. 91. The stairs, chimney, closets, and other details are also sized and located from dimensions found by counting squares in Fig. 91.

Draw the windows and doors by the same process. Symbols, fixtures, dimensions, lights, registers, and all other items are drawn in accordance with the principles of Chapter II.

Fig. 85B in Chapter V shows a complete working drawing for the floor plan discussed in the foregoing paragraphs. If you study this plan carefully, you will understand what items are necessary on a floor plan.

MAKING OLD ELEVATIONS. If you do not have drawings of the original elevations, you will have to make them just as you made the floor plans.

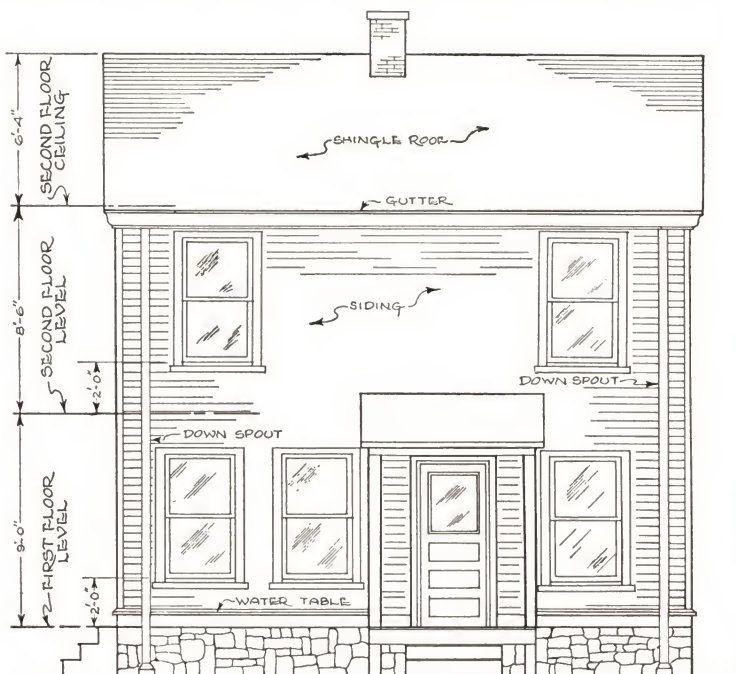


Fig. 95. Working Drawing for Elevation View Shown in Fig. 94

Fig. 94 shows a rough front elevation drawn on graph paper.

The distance *BF* represents the distance *GM* in Fig. 91. However, this distance should be checked by actually measuring the distance across the front of the house. The space from *A* to *B* in Fig. 94, represents the distance from the top of the foundation to the point where the side wall and roof meet. Measure this distance, and then lay it out on the rough drawing by counting squares.

The distance *GH* represents the amount the roof extends out from the exterior wall. The distance *GC* represents the height of the roof. These distances must be measured and laid out on the graph paper by counting squares.

The locations of windows and doors should be determined and their sizes measured; then they can be laid out on the graph paper by counting squares. The locations of all windows and doors should check with Fig. 91.

Measure the porch and all other details, and draw them on the graph paper in the same manner.

Making Working Drawings. From this rough but scaled drawing, such as Fig. 94, you must now make the working drawings. Use a large sheet of vellum paper and draw to a scale such as $\frac{1}{4}'' = 1'0''$. Lay out the bottom line like *BF* in Fig. 94, and then the end lines, *AB* and *JF*. Then draw in the roof lines. All distances are found by counting squares in Fig. 94.

Draw all other items of the elevation, put in symbols, dimensions, and other details, exactly as shown in Fig. 95.

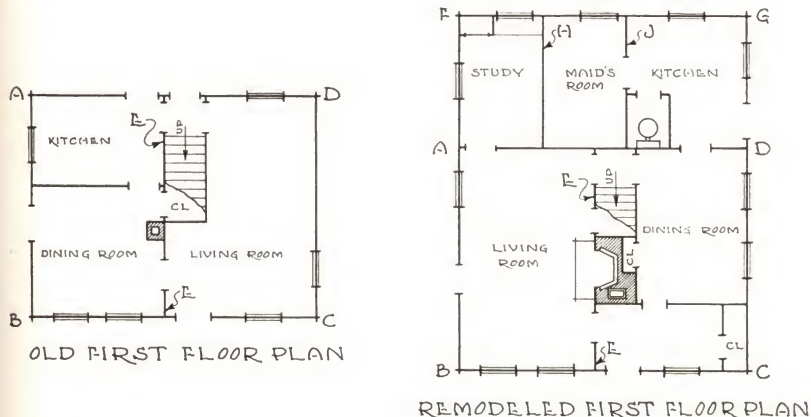


Fig. 96. Remodeling Drawings
Courtesy of U.S. Gypsum Company, Chicago, Ill.

Making Remodeling Working Drawings. Once the original drawings for your house are found, or have been drawn, the making of your remodeling drawings can go forward, after preliminary thinking as outlined in Chapters IV and V.

MAKING FLOOR PLANS. The remodeling drawings, both floor plans and elevations, will contain many features of the old drawings, as well as new features. Therefore, you must take care, in making the new drawings, not to lose sight of, or omit, any features of the old drawings which should be retained. The following procedure is a good one to follow:

Put the old first-floor plan, for instance, on the drafting board and line up all horizontal lines with the **T** square. Then put a piece of vellum paper directly over the old drawing. You can see the lines of the old drawing through the vellum.

The method of designing the remodeling of rooms and floor plans is explained in Chapters XV and XVI.

As the first step in making the remodeling drawing, trace all lines from the old

drawing which will also be part of the new drawing. For example, trace any walls or partitions which are to remain as they are. Next, add the new partitions and any additional walls.

Example. Note Fig. 96. Suppose your old first-floor plan has been drawn as explained in the foregoing pages. A piece of vellum paper is then put over it. Further suppose you want to enlarge your old house by adding rooms at the rear.

In the remodeling drawing for the first-floor plan, the walls marked *AB*, *BC*, *CD*, and *DA* will remain practically the same as in the original first-floor

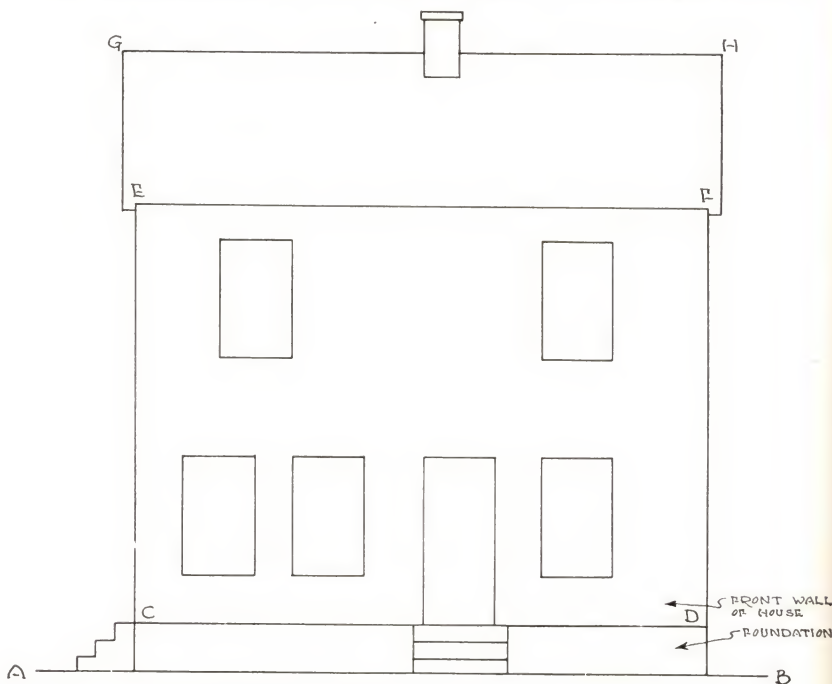


Fig. 97. Front Elevation Drawing for Complete Remodeling

plan. You can see this by studying the old and the remodeling plans shown in Fig. 96. Trace these walls first.

Next trace the partition marked *E* in the old floor plan, because part of it remains in the remodeled floor plan. At this stage you will draw it complete, and later erase a part of it as required.

New walls to be added to the remodeled floor plan are marked *AF*, *FG*, and *GD*. Draw these next, then the new partitions, marked *H* and *J*. From this point on, the other partitions, dimensions, windows, doors, and symbols can be drawn in until the remodeled floor plan is complete, as shown in Fig. 86B in Chapter V.

MAKING ELEVATIONS. Complete Remodeling. When a house is to be completely remodeled, it is generally best to draw the elevations without attempting to trace the old, as explained for floor plans. This is because the changes

are so extensive that tracing would be too complicated. The following procedure is recommended:

Example. Assume that the remodeling drawing for the front elevation is to be made to the same scale as the remodeled floor plans. First draw a horizontal line representing the surface of the ground. This is line AB in Fig. 97. Then draw another horizontal line above line AB indicating where the front wall of the house meets the foundation. Next note the over-all dimension across the front of the remodeled first-floor plan, shown in Fig. 96. This over-all dimension is BC . On the elevation drawing (Fig. 97), mark points C and D on the line between front

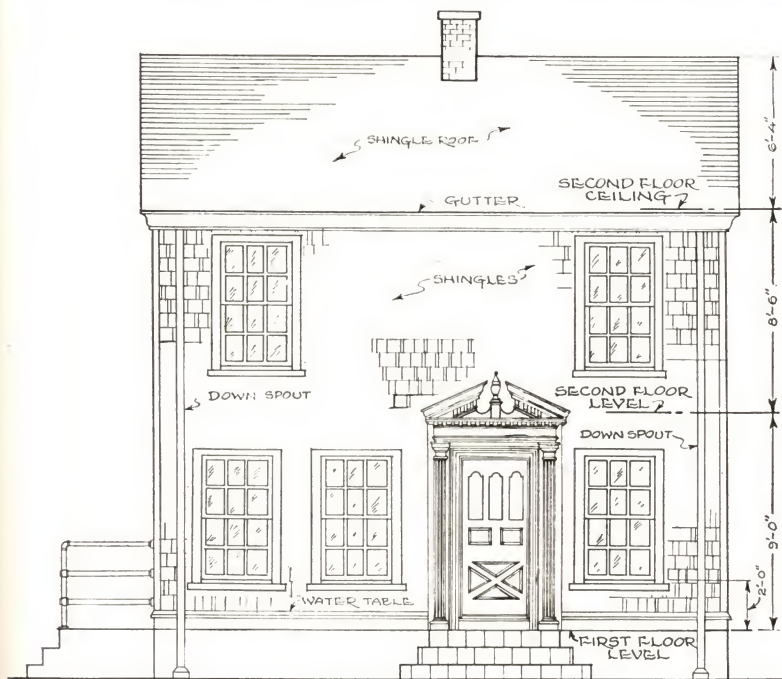


Fig. 98. Remodeled Elevation for House Shown in Figs. 94 and 95

wall and foundation, whose distance apart is equal to BC in Fig. 96. Next draw lines CE and DF in Fig. 97. The length or height of these lines represents the distance from the foundation to point A in Fig. 94. Next, in Fig. 97, draw line EF . This line represents the attic floor. The line GH , in Fig. 97, represents the top of the roof.

The window and door locations are determined from the floor plans. Their size on elevations depends on the actual sizes selected.

The design of remodeled elevations is explained in Chapter XVI.

All other details are drawn in, according to proper location and scale. Dimensions and symbols are added, as shown in Fig. 98.

Fig. 99 shows the remodeled left-side elevation for the same house as shown in Figs. 96, 97, and 98.

Partial Remodeling. In partial remodeling, where the exterior shape is not greatly changed, the tracing method explained for floor plans can be used to advantage.

Example. Suppose that the old elevation shown in Fig. 95 is to be partially remodeled. This old drawing can be put down on a drafting board and a piece of vellum placed over it. Then the main outline of the old elevation can be traced. The windows are to be replaced, but remain in the same position, so they can be drawn over the old ones. The chimney, front porch, siding, and shingles are to

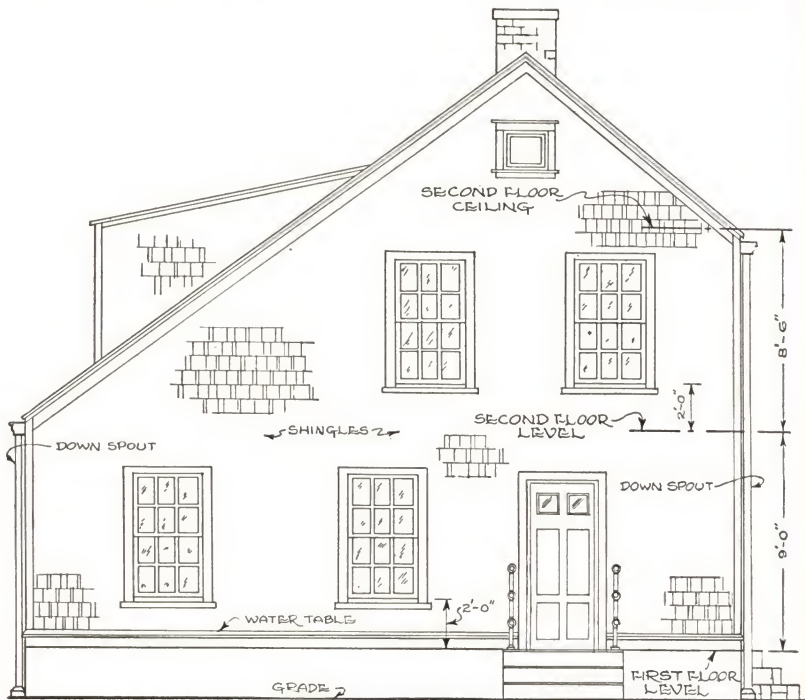


Fig. 99. Remodeled Left-Side Elevation for House Shown in Figs. 96, 97 and 98

be new, and they can be drawn in to replace the corresponding old items. When dimensions and symbols are drawn in, the result is Fig. 98.

When to Start Writing Specifications. In order to make sure that all necessary items are incorporated into the specifications for complete or partial remodeling, it is wise to keep notes as the remodeling drawings for the floor plans and elevations are made.

For example, as you are tracing and making the remodeling drawings for the first-floor plans, keep a notebook handy, and record each change from the old plans. As each change is noted, mark down also

the materials required, and other special instructions. If a window on the old drawings is to be relocated on the remodeling drawings, write this information in the notes at the time the window is being drawn in its new location. If new glass, new sash, and a change in size are required, record this information in the notes, also.

Follow the same procedure when the drawings for remodeled elevations are being made.

The recording of all changes, or additions, as they are being drawn will serve as a further check on their feasibility, and upon the accuracy of the drawings. The more thinking you do relative to drawings, the better they, and the final remodeling results, will be.

When all remodeling drawings are complete, your notes can be written up in the form of specifications as set forth in Chapter III. These recorded notes may be omitted from the final specifications, wherever the drawings show the same information clearly.

A study of the specifications in Chapter III, in conjunction with the blueprints in the back of the book, will give you an excellent idea of how remodeling specifications should be prepared.



CASEMENT WINDOWS AND HALF-TIMBER WORK IN THE STUCCO WALL OF A HOUSE
IN THE EARLY ENGLISH STYLE

Courtesy of Curtiss Companies, Incorporated, Manufacturers of Curtiss Woodwork, Clinton, Iowa

CHAPTER VII

Structural Details

THE structural details of a house consist of floor joists, rafters, wall and partition studs, supporting columns, lintels over window and door openings, dormer construction, foundations, and all other parts which go to make up the framework. These details are of special importance in remodeling work because of the limitations they impose on structural changes, and the special adjustments necessary when they are changed or omitted. In many cases the structural details are the deciding factor in determining whether remodeling changes can be accomplished within reasonable cost, if at all.

In this chapter, several typical structural details are explained from the standpoint of remodeling. You are urged to review Chapter II before beginning this study.

JOISTS. Primarily joists are the means of supporting floors and, in some cases, partitions. They are supported at both ends, ordinarily, and are sized and spaced according to the length of their span and the amount of load they must support. The loads are the live and dead loads, plus any partitions resting on the joists. The live load consists of furniture, fixtures, people, and all other items of a movable nature. The dead load is made up of the weight of the joists themselves, plus the flooring. When a group of joists supports a partition, the load which that partition supports, plus its own weight, must be added to the load on the joists.

Building codes and other building laws of cities, towns, and villages generally specify the live and dead loads that may be safely supported by joists of given sizes and spacings.

The following examples are typical of the problems in relation to joists, which are encountered in planning for remodeling.



Example 1. Suppose that in a remodeling work a wing is being added to an old house. In Fig. 100 the area $BCED$ represents a wing which is to be 15'0" wide as shown by the dimension. The section at AA shows the type of sill construction. This is the same as used in the Western Frame, illustrated in Fig. 64 of Chapter II. The joists run from side DE to side BC as indicated by the dash lines. Ordinarily, in an example of this sort we can assume the live load to be 40 pounds per square foot and the dead load 20 pounds per square foot.

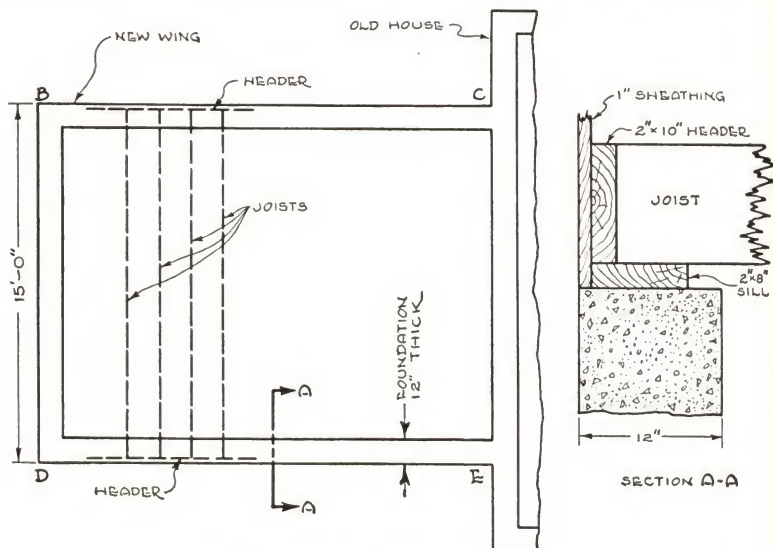


Fig. 100. Joists for New Wing of an Old House

To select the size and spacing of the joists we must assume they are of a certain size and spacing, and then we must investigate to see if the assumption is correct. (In remodeling it is often desirable to use joists of the same size as those in existing parts of the house.) In this instance, we assume the joists are 2x10's, spaced 16" center to center. In order to investigate the size and spacings of these joists we must calculate the area supported by any one joist. Such an area is called the *tributary area* and is found by multiplying the length of the joist by half the distance from the center of a given joist to the joists on either side. The length can be calculated as follows:

As shown in Section AA in Fig. 100, the joists rest on a sill and are up against a header. The header plus the sheathing—2" + 1"

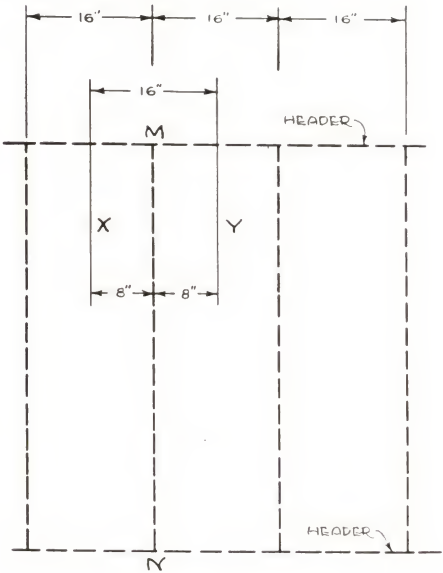


Fig. 101. Tributary Areas

(approximately)—equals 3". The header and the sheathing are the same on both sides, so two times 3 inches equals 6 inches to be deducted from the over-all dimension, 15'0". Thus the length of

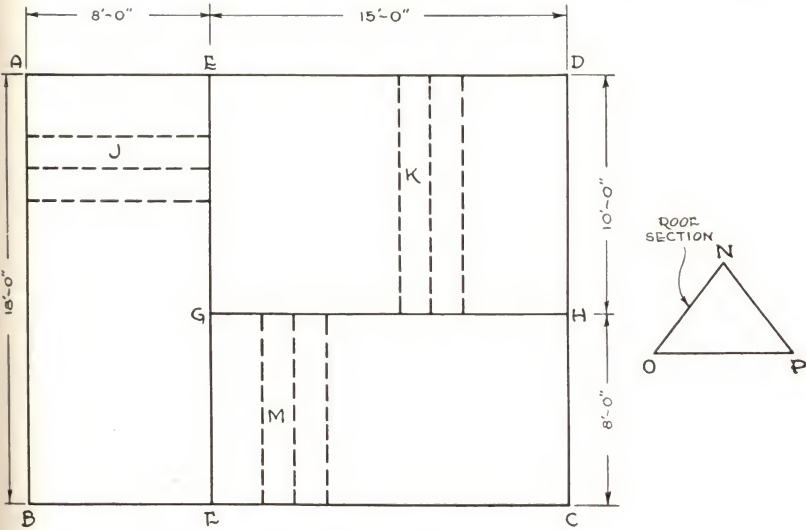


Fig. 102. Ceiling Joists for a One-Story House

Table 5. Rectangular Wooden Beams—One Inch Thick Long-Leaf Pine

Allowable Uniform Load in Pounds
Maximum Bending Stress, 1,300 Pounds per Square Inch

Span in Feet	Depth of Beam in Inches											
	2	4	6	8	10	12	14	16	18	20	22	24
	320											
2	289											
3	193	640										
4	144	578										
5	116	462										
			960									
6	96	385	867									
7	83	330	743	1280								
8	72	289	650	1156								
9		257	578	1027	1600							
10		231	520	924	1444							
						1920						
11		210	473	840	1313	1891						
12		193	433	770	1204	1733	2240					
13			400	711	1111	1600	2178					
14			371	660	1032	1486	2022	2560				
15			347	616	963	1387	1887	2465				
16			325	578	903	1300	1769	2311	2880			
17				544	850	1224	1665	2175	2753			
18				514	802	1156	1573	2054	2600	3200		
19				487	760	1095	1490	1946	2463	3041	3520	
20				462	722	1040	1416	1849	2340	2889	3496	
21					688	991	1348	1761	2229	2751	3329	3840
22					657	945	1287	1681	2127	2626	3178	3782
23					628	904	1231	1608	2035	2512	3040	3617
24					602	867	1180	1541	1950	2407	2913	3467
25						832	1132	1479	1872	2311	2796	3328
26						800	1089	1422	1800	2222	2689	3200
27						770	1049	1370	1733	2140	2589	3082
28						743	1011	1321	1671	2064	2497	2971
29							976	1275	1614	1992	2411	2869
30							944	1233	1560	1926	2330	2773

Maximum Spans in Feet for Deflections = 1/360 Span

Species of Timber	Depth of Beam in Inches											
	2	4	6	8	10	12	14	16	18	20	22	24
Long-leaf Pine	1.4	2.8	4.1	5.5	6.9	8.3	9.6	11.0	12.4	13.8	15.1	16.5

Horizontal Lines Indicate the Limit for Resistance to Shear in the Horizontal Direction of the Grain.

the joists is 14'6". Fig. 101 shows an enlarged view of the joists illustrated in Fig. 100. Thus in Fig. 101 the joist length, MN , is 14'6". The dimension lines X and Y represent distances halfway to the joists on either side of MN . The tributary area for joist MN is therefore 14'6" times 16" or $14\frac{1}{2} \times 1\frac{1}{3} = 19\frac{1}{3}$, call it 20, square feet. The total load supported by MN is $20 \times (40 \text{ pounds live load} + 20 \text{ pounds dead load})$, or 20×60 , which equals 1,200 pounds.

Now note Table 5. This table shows the safe loads that wood beams (joists) one inch thick can support over various spans. For instance, the table shows that a 1"x10" over a 15-foot span can safely support 963 pounds. Then a 2"x10" can safely support two times 963 or 1,926 pounds. Thus the 2"x10" joist MN is more than strong enough and has a good factor of safety when spaced 16" on center.

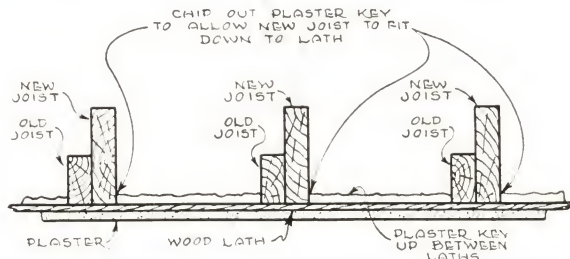


Fig. 103. Putting New and Larger Joists in an Old Ceiling

Other sizes and spacings of joists are investigated in like manner. It is generally best to use standard joist spacings such as 12" and 16", so that standard-sized materials can be applied without cutting.

Example 2. In many instances remodeling jobs include making bedrooms or other rooms in the attic space of a one-story house where 2"x4" ceiling joists were used. Such joists generally are too small to support floor loads. Therefore, some provision must be made for increasing their size or number.

The rectangle $ABCD$, in Fig. 102, represents the ceiling joists in a one-story house having a roof section as shown at NOP on the right of the drawings. EF and GH are bearing partitions, supporting one end of the joists at J , K , and M . To put in larger joists without disturbing the ceiling plaster requires that the new joists be installed as shown in Fig. 103.

The new joists should have the same spacing as the old ones if

possible. Their size can be determined by trial as explained in Example 1. When installing the new joists the plaster keys can be chipped so that the joists touch the laths. Then the new joists will support the floor, and the old ones will continue to carry the plastered ceiling.

In cases where new ceilings are required, the old joists may be entirely removed.

Example 3. In old houses, especially in the larger rooms, floors have a tendency to sway, creak, crack the plaster, and give under loads such as pianos and other heavy pieces of furniture. Generally the reason is that the old joists are too small, or too widely spaced, or have not been stiffened by the use of bridging. Whatever the cause, it is advisable to check the joist size and spacing. To do this, calculate the tributary area and the total load. Then refer to Table 5 and see

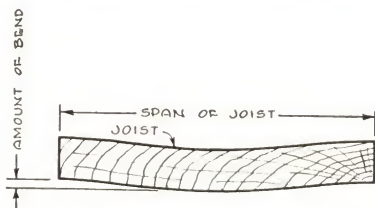


Fig. 104. Bent Joist

if the old joists are of sufficient size. If they are not, they can be strengthened by adding a new joist of the same size next to each old one, somewhat as shown in Fig. 103.

In a case of this kind, care should be exercised to obtain either used joists or joists that have been exceptionally well seasoned, in order to avoid trouble due to the shrinkage of new and unseasoned (green) joists.

If old plaster and flooring are to be removed, a line of bridging can be run between joists which will further stiffen them.

Example 4. In some old houses the joists under large rooms have definite tendencies to bend downward, either because of age or poor original design. In such cases the floor in the center of a room may be much lower than around the edges. This causes plaster cracks, unsightly appearance, and difficulty in placing furniture.

Fig. 104 illustrates, in exaggerated form, a joist which sags near the middle of the span. If joists in a first-floor framing are in the con-

dition shown in Fig. 104 there are two simple methods of correcting the trouble.

First. The joists can be jacked up until the surface of the floor is very nearly level, and an I beam or wood girder can be placed under them as shown in Fig. 105. The beam must be supported at both ends either by walls or lally columns. If one end is supported by a wood partition it is advisable to put a 2"x6" upright in the partition directly under the beam.

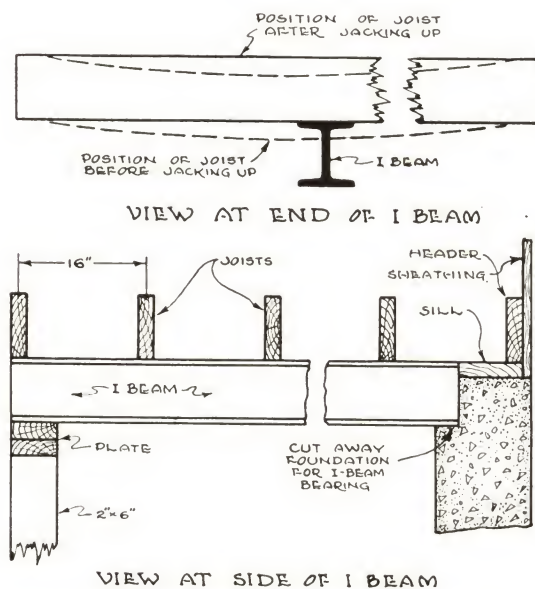


Fig. 105. Supporting Bent Joists by an I Beam

Second. The joists can be jacked up the required amount and then reinforced by adding a new joist alongside of each old one and spiking the two joists together.

If joists in a second- or third-floor framing are in the condition shown in Fig. 104, supporting them is much more difficult. However, there are two common methods of accomplishing the desired results.

First. If the plaster on the under side of the joists is to be replaced, a new joist can be added alongside of each old one, as mentioned previously. Unless the added joists are of used material or

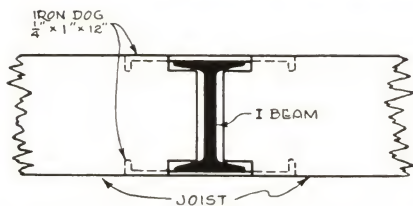


Fig. 106. I Beam Through Center of Span to Support Joists

thoroughly seasoned, the lathing should be nailed to the original joists only.

Second. Fig. 106 shows how an I beam can be used through the center of a span to support joists. The joists must be temporarily supported, after being raised the required amount, then cut, and the beam put into place. The beam must have ample support at both ends.

BRIDGING. Fig. 107 shows how bridging is used between joists. Bridging may be made of 1"x2" strips of wood or of especially de-

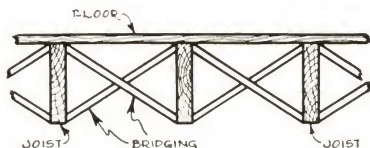


Fig. 107. Bridging Between Joists
(See Example in Fig. 108)

signed metal. The purpose of bridging is to keep the joists in an exactly upright position because in that position they are strongest and give a floor framing the greatest stiffening effect.

Bridging should be used between all joists having a span greater than 10 or 12 feet. It is run along the center of the span. Old joists can in many instances be given greater strength by adding a line of bridging to them; no new framing over 10 or 12 feet should be without it.

LUMBER. The new lumber used in remodeling work should be selected with care, especially for joists, studs, plates, sills, and other structural members where shrinkage would cause the new work to get out of line with the old.

Lumber which has not been properly seasoned is called *green* and has a high moisture content. If such lumber is used in structural

parts it gradually loses its moisture content (dries) and shrinks in size across the grain. This shrinkage is enough to cause serious trouble,

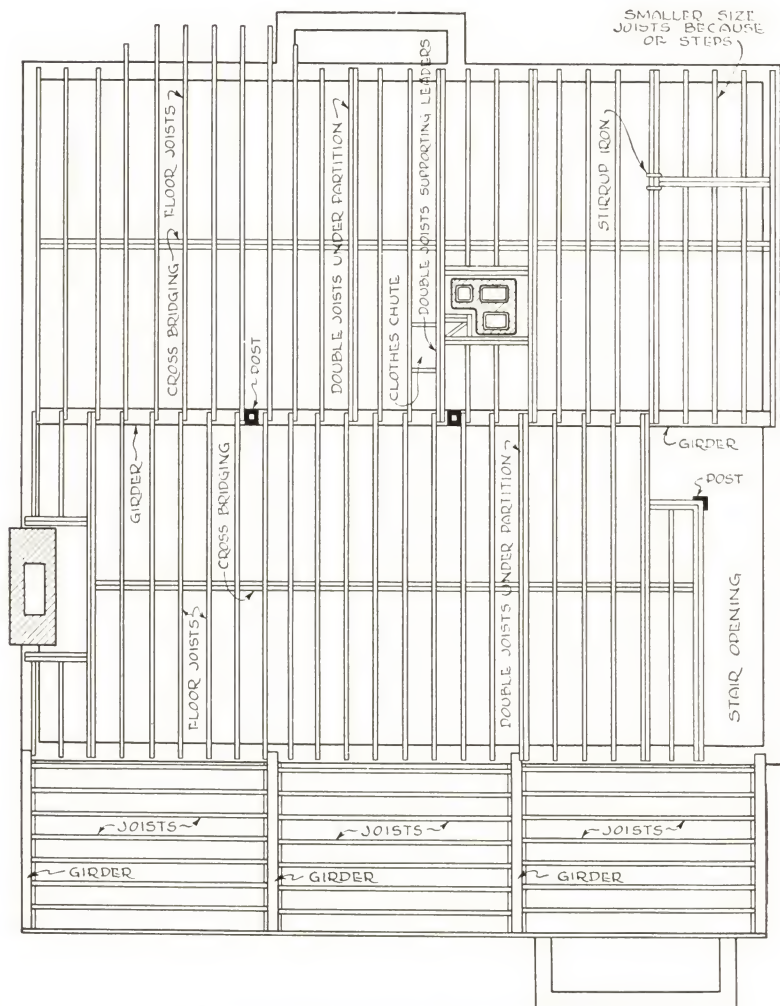


Fig. 108. Illustration of Bridging and Double Framing

especially in remodeling where it creates differences in heights between old and new parts.

Lumber can be kiln-dried to the point where it can safely be used in remodeling. Thoroughly dry (well-seasoned) lumber can be differ-

entiated from green lumber, because it is much lighter in weight. Used lumber can be employed to good advantage if it is in good condition and has been kept dry. The shrinkage has already taken place, so its use need not be feared from that angle. However, the strength of used joists should not be considered the same as for new lumber. It would be wise to assume that they are only about $\frac{2}{3}$ as strong as new lumber, and to make corresponding adjustments when using Table 5.

DOUBLE FRAMING. There are several instances where framing members should be doubled in order to avoid trouble.

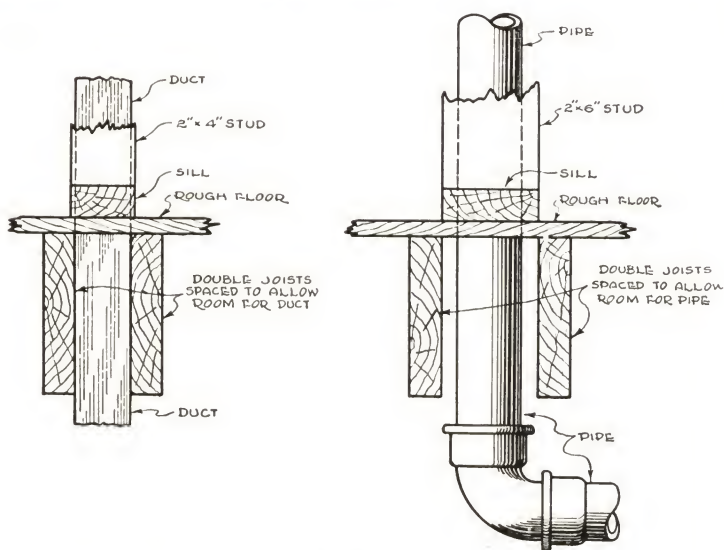


Fig. 109. Double Joists Under Partitions Spaced to Allow Room for Ducts and Pipes

Around Openings. Wherever there is an opening in a floor for a fireplace, a chimney, or a stairway, the joist framing around the openings should be doubled. Note the double framing in Fig. 108. You will see that the openings around the fireplace and chimney have double joists and that double joists are also used around the stair opening.

Double Joists Under Partitions. Fig. 108 also shows how double joists are used under partitions to increase the support for the added loads on the floor framing at those points.

If a duct, or water or soil pipe must run up through a partition,

the two joists under it can be spaced far enough apart to allow the required room as shown in Fig. 109.

Double Joists Under Bathrooms. In remodeling work where new or modernized bathrooms are being installed over old joists it is generally wise to double all joists by adding new joists alongside of each old one in the entire area under the bathroom. This practice will prevent troubles due to the heavy loads occasioned by the fixtures, and by water added to the weight of the bathtub.

CUTTING FRAMING MEMBERS FOR DUCTS AND PIPES. In the framing for floors and walls the joists and studs each support a definite amount of the total load. Thus we must consider each joist or stud individually and understand that if one of them fails, an undue

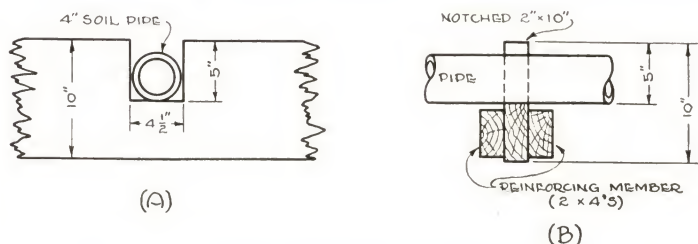


Fig. 110. (A) Joist Cut for Piping (B) Reinforcement of Cut Joist

load is forced on the others and may cause the failure of part of a floor or a wall.

Cutting Joists. Sometimes plumbers or heating men have to cut joists to some extent in order to run pipes or ducts to required locations. Such cases often occur in remodeling work.

Suppose a new bathroom is being installed and that the plumber has no alternative but to cut one or more joists to make room for the soil pipe for the water closet. Further suppose they are 2"x10" joists. To run the pipe below the floor, the joists would have to be cut as shown at A in Fig. 110.

If a 2"x10" joist has a notch 5 inches deep cut in it, the whole joist is no stronger than at the notch. Or, in other words the strength of the joist is reduced to the strength of a 2"x5" joist. Ordinarily such a weakening is dangerous, and some means of strengthening the joist must be employed. At B in Fig. 110 we show a way to nail 2"x4" pieces on either side of a cut joist to reinforce it. These rein-

forcing members may be 4 or 5 feet long, or even the full length of the joist.

Fig. 111 shows other ways in which cut joists may be reinforced. Note that the double joists under the partition are spaced to allow room for the soil stack.

RAFTERS. New roofs are often required in remodeling work, and the method of selecting the size and spacing of the rafters is somewhat the same as explained for joists.

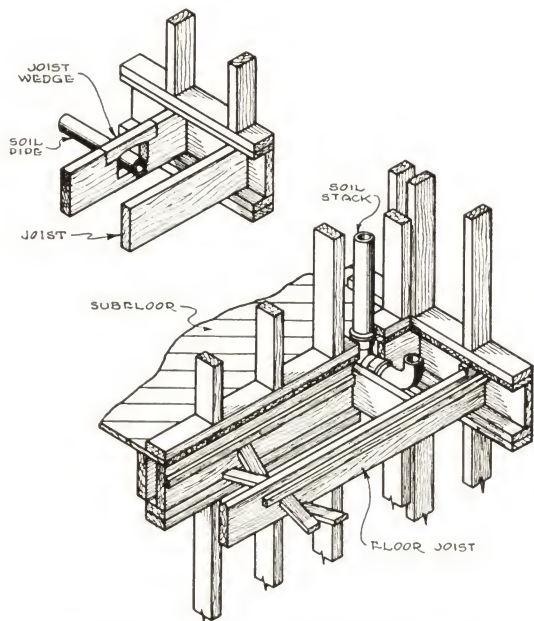


Fig. 111. Other Ways of Reinforcing Joists Which Have Been Cut

Example 1. Suppose that the sketch at A in Fig. 112 represents two typical rafters in a roof spanning 32'0". Rafters, unlike joists, have their tributary areas calculated on their horizontal projection instead of their actual length. The horizontal projection is shown at B in Fig. 112. Rafter AB has a horizontal projection equal to AC which is 16'0" or just half the total span. Assume, as a trial, that the rafters are 2"x6", that they are spaced 16" O.C., and that the combined live and dead load is 35 pounds per square foot. The tributary area is then 16 times $1\frac{1}{3}$ or $21\frac{1}{3}$, call it 22, square feet. The total

load per rafter is then $22 \times 35 = 770$ pounds. Table 5 shows that a 1"x6" beam can carry 325 pounds safely over a 16-foot span. Therefore a 2"x6" can carry 650 pounds. This means that 2"x6" rafters spaced 16" O.C. are not strong enough. Next try spacing them 12" O.C. The tributary area is 16×1 or 16 square feet. The total load is $16 \times 35 = 560$ pounds. We see that the 12-inch spacing is satisfactory, since 560 is less than the safety load of 650.

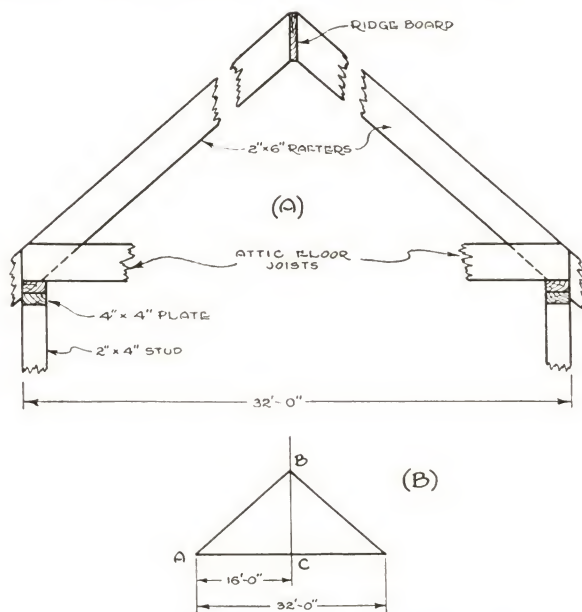


Fig. 112. (A) Two Typical Rafters (B) Horizontal Projection

Double Framing. Rafters should be doubled wherever openings for dormers, chimneys, or scuttles occur. The procedure is the same as that explained for joists.

REMOVING OLD BEARING PARTITIONS. In remodeling interiors it often happens that a bearing partition has to be removed in order to make rooms larger or to change room locations. Bearing partitions carry floor loads from above and if they have to be removed, some provision must be made to carry the loads they were designed to carry. In most cases this can be accomplished easily. The following paragraphs explain typical methods used to support loads where bearing partitions must be removed.

joists for the attic floor. Thus partitions *X*, *Y*, and *Z* are bearing partitions.

Suppose that in remodeling, the removal of partitions *X* and *Y* was necessary in order to make a large recreation room in the basement and a large living room on the first floor. Then some means

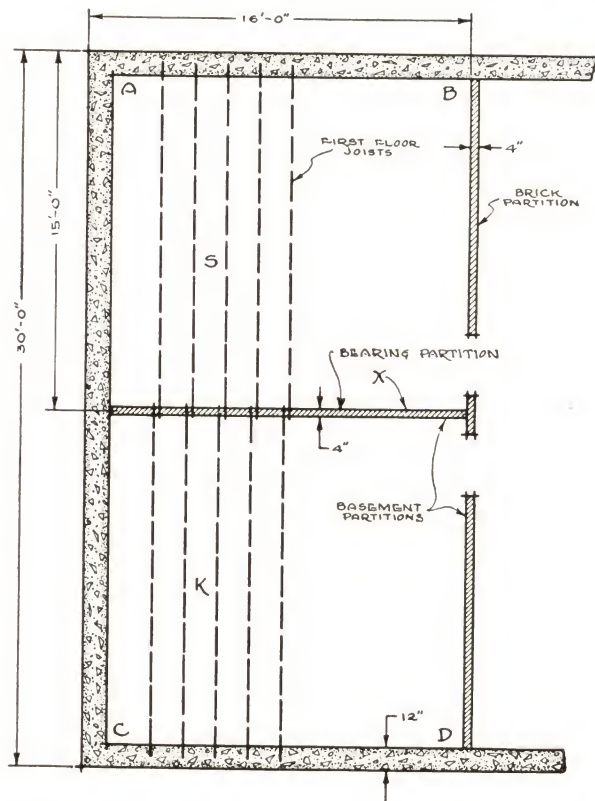


Fig. 114. Part of a Basement Plan Showing How Bearing Partition Supports First-Floor Joists

must be provided to support the interior ends of the first- and second-floor joists at *U* and *T*.

To visualize this situation more clearly, study Figs. 114 and 115 which show the basement and first-floor areas before remodeling. In Fig. 114 the area *ABDC* is to be made into the large recreation room, and the partition marked *X* is the same as *X* in Fig. 113 and is to be removed. In Fig. 115 the area *ABDC* is to be made into the large

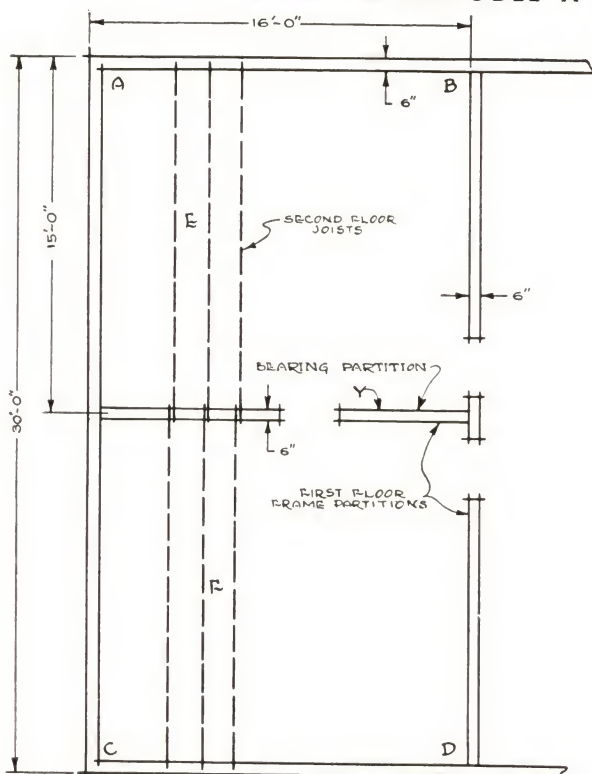
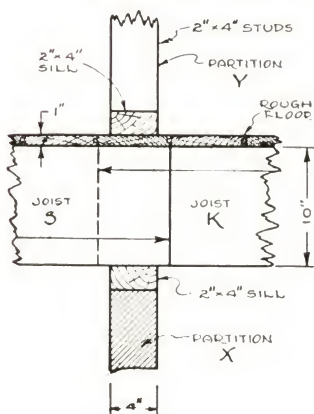
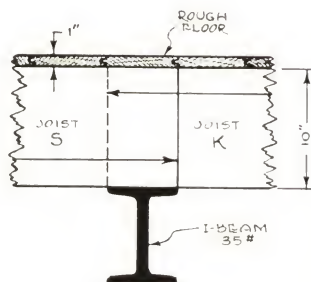


Fig. 115. Part of First-Floor Plan Showing How Bearing Partition Supports Second-Floor Joists (Directly Above Area in Fig. 114)



SECTION U
BEFORE REMODELING



SECTION U
AFTER REMODELING

Fig. 116. Section U, Shown in Fig. 113, Before and After Remodeling

living room and the partition marked *Y* is the same as *Y* in Fig. 113. The joists marked *S* and *K* in Fig. 113 are the same as the joists marked *S* and *K* in Fig. 114. The joists marked *E* and *F* in Fig. 113 are the same as the joists marked *E* and *F* in Fig. 115.

First, consider the removal of the basement partition, *X*. When the brick-bearing partition is removed, an **I** beam can be placed

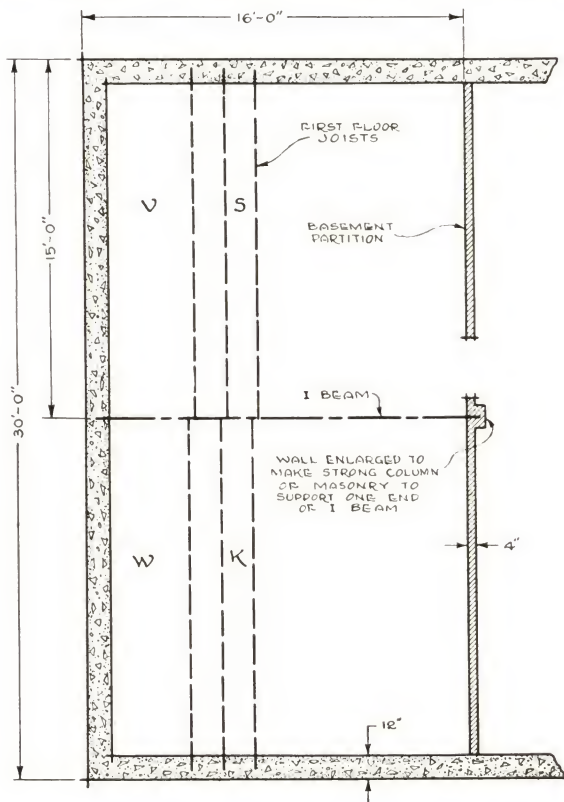


Fig. 117. Remodeled Plan of Fig. 114 Showing How **I** Beam Is Used in Place of Bearing Partition

directly under the point where the top of the old partition was. This is shown in Fig. 116 and also in Fig. 117.

To remove the old partition and put in the **I** beam, the joists on either side of the partitions should be supported by temporary timberwork. Then the old partition can be removed and the **I** beam put in place. At one end the **I** beam is supported by the foundation (some-

Table 6. Steel I Beams

Allowable Uniform Load in Thousands of Pounds
Maximum Bending Stress, 16,000 Pounds per Square Inch

Span in Feet	Depth and Weight of Sections											Coefficient of Deflection	
	10-inch		9-inch		8-inch		7-inch	6-inch	5-inch	4-inch	3-inch		
	40 lbs.	25.4 lbs.	35 lbs.	21.8 lbs.	25.5 lbs.	18.4 lbs.	15.3 lbs.	12.5 lbs.	10 lbs.	7.7 lbs.	5.7 lbs.		
1													
2	149.8		131.8		86.6				27.6	21.0	15.2	10.2	0.02
3	112.8		88.3	52.2	60.8	43.2	35.0	25.8	17.2	10.6	5.9	8.8	0.07
4	84.6	62.0	66.2	50.3	45.6	37.9	27.6	19.4	12.9	8.0	4.4		0.15
5	67.7	52.1	53.0	40.3	36.5	30.3	22.1	15.5	10.3	6.4	3.5		0.27
6	56.4	43.4	44.2	33.6	30.4	25.3	18.4	12.9	8.6	5.3	2.9		0.41
7	48.4	37.2	37.9	28.8	26.1	21.7	15.8	11.1	7.4	4.5	2.5		0.60
8	42.3	32.6	33.1	25.2	22.8	19.0	13.8	9.7	6.4	4.0	2.2		0.81
9	37.6	28.9	29.4	22.4	20.3	16.9	12.3	8.6	5.7	3.5			1.06
10	33.9	26.0	26.5	20.1	18.2	15.2	11.0	7.7	5.2	3.2			1.34
11	30.8	23.7	24.1	18.3	16.6	13.8	10.0	7.0	4.7				1.66
12	28.2	21.7	22.1	16.8	15.2	12.6	9.2	6.5	4.3				2.00
13	26.0	20.0	20.4	15.5	14.0	11.7	8.5	6.0					2.38
14	24.2	18.6	18.9	14.4	13.0	10.8	7.9	5.5					2.80
15	22.6	17.4	17.7	13.4	12.2	10.1	7.4						3.24
16	21.2	16.3	16.6	12.6	11.4	9.5	6.9						3.72
17	19.9	15.3	15.6	11.8	10.7	8.9							4.24
18	18.8	14.5	14.7	11.2	10.1	8.4							4.78
19	17.8	13.7	13.9	10.6									5.36
20	16.9	13.0	13.3	10.1									5.98
21	16.1	12.4											6.62
22	15.4	11.8											7.30
													8.01

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.

what as shown in Fig. 105) and at the other end by a brick column made by enlarging the other brick partition as shown in Fig. 117.

The **I** beam extends below the ceiling level but it can be boxed in and plastered around. Also false beams may be constructed at *V* and *W*, parallel to the **I** beam, to give the impression of a beamed ceiling. This takes care of the matter of appearance.

The selection of the **I** beam, as to size, depends on the floor load it must support. If partition *Y* (Fig. 113) is also to be removed then the load the **I** beam must support is the total of the live and dead loads from the first floor.

From Figs. 114 and 117 it will be seen that the floor area involved is roughly 30'0" by 16'0". However, joists at *S* and *K* are supported at one end by the foundation. Thus the foundation really supports half of the loads on joists *S* and *K*. This means that the **I** beam supports the floor loads half way to the foundation on either side of it. The tributary area for the beam is then $15 \times 16 = 240$ square feet. If we assume that the live and dead loads per square foot for the floor total 60 pounds, then the total load which the beam must support is $240 \times 60 = 14,400$ pounds. Looking in Table 6 we see that a 9'-I-35

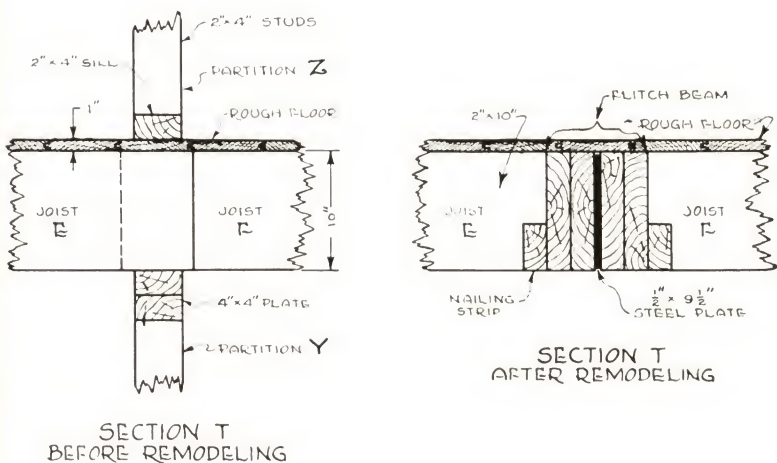


Fig. 118. Section T, Shown in Fig. 113, Before and After Remodeling

pound beam can safely carry 16.6 or 16,600 pounds over a 16-foot span. Thus this size beam can be used in place of partition *X*. In the beam symbol, 9" is the depth of the beam, the **I** indicates **I** beam, and the 35 means 35 pounds per lineal foot.

Next consider the removal of partition *Y*. An **I** beam cannot very well be used here, as shown in Fig. 106, as there is no way of putting it in place without first removing the joists. Also an **I** beam such as shown in Fig. 116 would not be satisfactory unless we want to have a beamed ceiling in the living room. A Flitch beam, as shown in Fig. 118, could be used. To install such a beam the joists are first temporarily supported. Then the ends of the joists are cut to fit the beam, after which it is put in place. It might be wise to put a 4x6

in the interior partition, as shown in Fig. 119, to form a more solid support for the end of the beam.

In some instances a built-up girder, composed of 3 or 4 joists spiked together (minus steel plate shown in Fig. 118) can be used, depending on the amount of load to be supported.

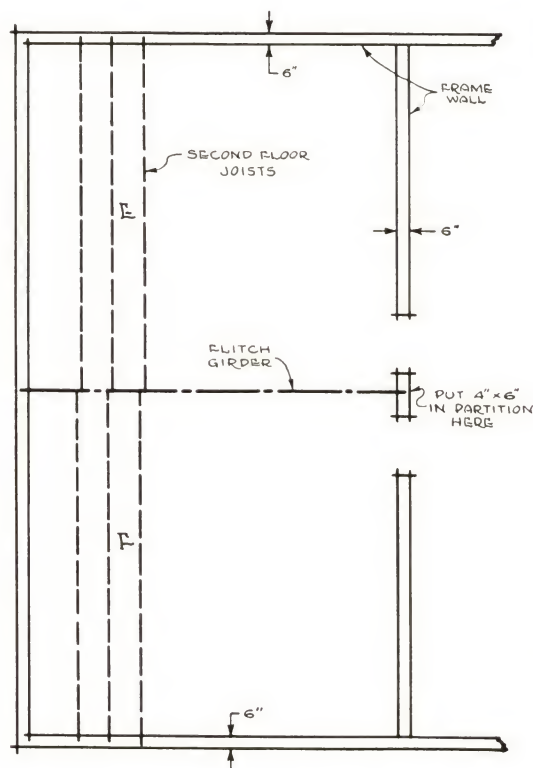


Fig. 119. Remodeled Part of First Floor Showing How a Flitch Girder Might Be Used to Support Second-Floor Joists

We compute the total load to be supported by the Flitch beam exactly as we did in the case of the **I** beam. It totals to 14,400 pounds. To select the proper size of Flitch beam we must assume a size, and then investigate.

Let us assume the steel plate size is $\frac{1}{2}$ " \times 9 $\frac{1}{2}$ " and that 4 pieces of 2" \times 10" pine joists are used.

The formula for investigating is:

$$W = \frac{2 \times D^2}{L} (fb + 750t)$$

Where

W = safe load

D = depth of steel plate

f = coefficient of strength (pine = 100)

b = total breadth of timber

t = thickness of steel plate

L = span

Substituting

$$W = 2 \times \frac{91\frac{1}{2}^2}{16} (100 \times 8 + 750 \times \frac{1}{2})$$

$$W = 2 \times \frac{90.25}{16} (800 + 375)$$

$$W = 2 \times 5.64 (1,175)$$

$$W = 2 \times 6,627$$

$$W = 13,254 \text{ pounds}$$

This 13,254 is somewhat less than 14,400 but it is close enough to be safe. However, had the difference been considerable, we would have had to substitute thicker joists in order to increase the size of the safe load. In this particular case the span is not actually 16 feet, so the 13,254 figure is safe enough.

Columns. It sometimes happens that when an **I** beam, such as in Fig. 117, is used in place of a bearing partition there is no means of supporting the interior end, either because there is no partition, or because the partition cannot be made strong enough. For example, suppose there were no means of supporting the interior end of the beam in Fig. 117. In such a case a Lally column could be used. These columns are round and have iron exteriors. They come in various sizes and are selected according to the weight and length of the loads they must support. For ordinary purposes the light-weight columns are sufficiently strong. They have a plate at the top on which the **I** beam can rest and to which it can be bolted.

When Lally columns are used, a concrete footing at least 18 inches square and 12 inches deep should be provided for them so as

to distribute the load they carry over a greater area and thus prevent settling.

WIDE OPENINGS IN WALLS. Frame Walls. Many times in remodeling it is desirable to construct a wide archway or opening in a wall, making two rooms practically one but still retaining the outlines of the original rooms. Or, wide archways are often desirable between living rooms and stairhalls and in similar places.

When two or more studs, in a first-floor partition, are removed

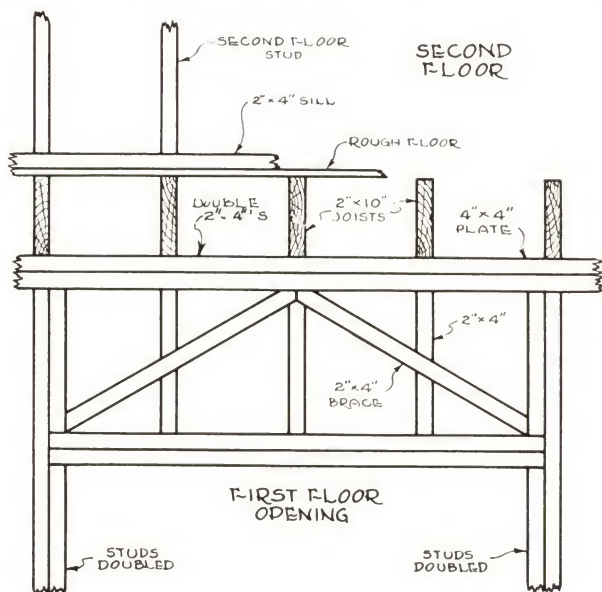


Fig. 120. Framing for Wide Opening in First-Floor Partition

for most of their length in order to make a wide opening, special provisions must be made to support the joists and partitions above.

Fig. 120 shows a recommended method of framing to provide a wide opening in a first-floor partition and at the same time make provision for supporting joists and a second-floor partition. The studs on both sides of the opening should be doubled and double 2x4's should be placed over the opening. The braces and other members must be cut to fit tightly and securely nailed. If a curved arch is required, metal curves, ready to install, can be purchased in several different lengths.

Brick Walls. Openings made in old brick walls require **I** beams or angle irons for supporting the brickwork above the openings and any other load which that portion of the wall carries.

Fig. 121 shows a wide opening assumed to have been cut in the old brick wall in order to combine part of the old house with a new room addition. The position of the **I** beam above the opening is shown in the section view. The span is 13'9".

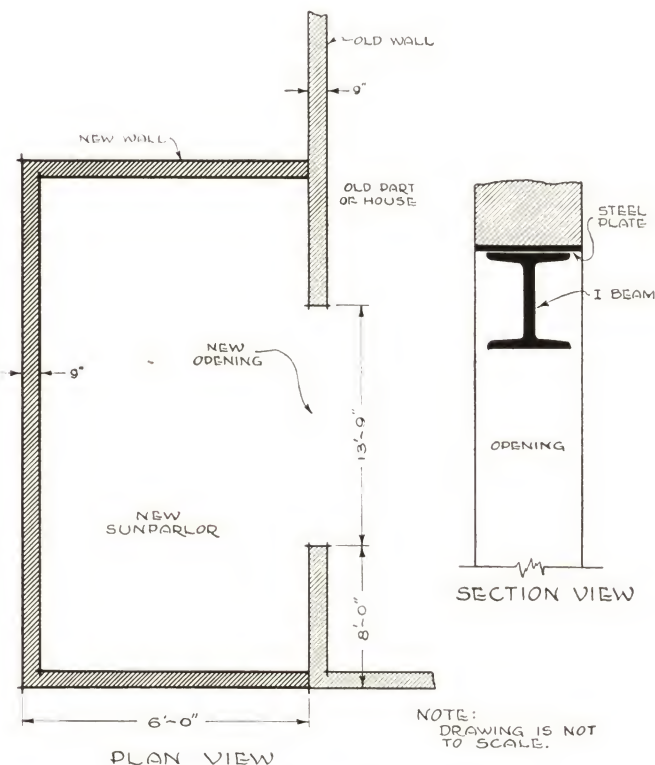


Fig. 121. Wide Opening in Brick Wall

In a two-story house, the weights and loads which the **I** beam must support are as follows:

We assume the brick wall above the beam to be 9'0" high and to weigh 80 pounds per square foot. To find the total wall weight, multiply the height by the weight per square foot by the span. Assume that the roof weighs 10 pounds per square foot and is 14 feet

from hip to eaves. Assume the attic floor weighs 16 pounds per square foot and that half the distance from beam to next support is 8 feet. Suppose that the sun parlor roof weighs 10 pounds per square foot and that half of the span from beam to next support is 3 feet. The second floor can be assumed to weigh 25 pounds per square foot, half the distance from beam to next support being 8 feet. Suppose the weight of the beam is 40 pounds per lineal foot.

The dead load calculations are as follows:

Brick wall.....	$13.75 \times 9 \times 80 =$	9,900 pounds
Roof.....	$13.75 \times 10 \times 14 =$	1,925 pounds
Attic.....	$13.75 \times 16 \times 8 =$	1,760 pounds
Sun parlor roof.....	$13.75 \times 10 \times 3 =$	413 pounds
Second floor.....	$13.75 \times 25 \times 8 =$	2,750 pounds
Beam weight.....	$13.75 \times 40 =$	550 pounds
Total dead load.....	$=$	17,298 pounds

We will suppose that the live load per square foot of floor is 30 pounds, excepting the roof which has 25 pounds of live load per square foot of floor.

The live loads are calculated as follows:

Roof.....	$13.75 \times 25 \times 14 =$	4,810 pounds
Attic.....	$13.75 \times 30 \times 8 =$	3,300 pounds
Second floor.....	$13.75 \times 30 \times 8 =$	3,300 pounds
Sun parlor roof.....	$13.75 \times 30 \times 3 =$	1,240 pounds
Total live load.....	$=$	12,650 pounds

The total dead and live load is $17,298 + 12,650 = 29,948$. Call it 30,000 pounds.

To support this load safely over a span of say 14 feet, a 12''-I-40 pound beam is required.

Once the total load and span are computed, any steel manufacturer or sales office will advise the size of beam required.

WINDOW OPENINGS. Frame Walls. Fig. 122 illustrates a commonly used method of framing for window openings in frame walls. The double framing is clearly shown.

Brick Walls. When small openings are made in brick walls, as for new windows, the brickwork immediately above the opening must be supported. Angle irons ordinarily are used for that purpose. When an opening is made it is assumed that the brickwork is a near-circular

arch of the diameter of the opening, and the angles (called lintels) need carry no load above this arch except floor loads which are distributed uniformly over the opening.

Suppose a new first-floor window is being put in an 8" brick wall. The window is 3'6" wide. The formula to use for calculating the weight is

$$\text{Weight} = \frac{\pi}{4} \times \frac{(3.5)^2}{2} \times 90$$

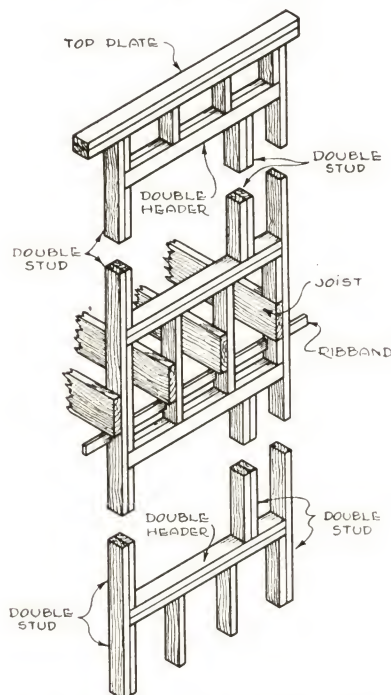


Fig. 122. Framing for Two Window Openings in a Balloon Frame Bearing Wall

Where

$$\pi = 3.1416$$

The 3.5 is the width of window, 3'6".

The 90 is weight of brick wall per square foot.

Solving

$$\begin{aligned} \text{Weight} &= .7854 \times 6.125 \times 90 \\ &= 433 \text{ pounds} \end{aligned}$$

Sometimes a wall supports one end of the second-floor joists and thus carries the floor load half the distance to the other support, as explained previously. If we assume that half the distance to the next support is 8 feet, then for a 3.5-foot opening the area will be $8 \times 3.5 = 28$ square feet. Assuming that the combined live and dead load is 60 pounds per square foot, the total floor load over the opening is $28 \times 60 = 1,680$ pounds. The total of weight and load over the opening is then $433 + 1,680 = 2,113$ pounds.

When the total load and the span are known, any building materials sales office can advise what size of angle irons to use. Two angles should be used for each opening, not only to carry the load but to make a bearing surface for the brick work.

FOUNDATIONS AND FOOTINGS. When additions to old houses are part of remodeling operations, special care should be given the matter of foundations and footings in order to avoid such troubles as listed below:

1. Action of frost, causing ground to rise and fall.
2. Cracks, uneven floors, etc., caused by settlement.
3. Rotting or decay of wood structural parts, caused by contact with damp ground.
4. Water in basements caused by poor foundations.

Action of Frost. Practically all earth has moisture in it by reason of rain, snow, and natural dampness. During freezing weather this moisture turns to ice, and the ground is said to be frozen. Water expands in freezing; thus frozen ground expands and tends to rise above its natural elevation. Then when thawing takes place, the ground settles back to its natural elevation. This alternate rising and falling would cause cracking and many other structural troubles in a house unless the foundation were made to extend *below* the frost line to prevent such injury. The depth of the frost line varies with geographic location. You can find out what it is by questioning the builders in your locality.

In remodeling work it is particularly important to set the new foundations well below the frost line. It is safe to assume that the foundations of the old house are deep enough. If the foundations for the addition are not sufficiently deep, that part of the house will rise and fall, causing serious trouble where new and old structural parts are joined.

Settlement. Unless foundations and footings under additions are well made, and equal to supporting the loads upon them, they are very likely to settle or fail. Settling in one or more places allows the floors and walls to settle also, which might cause enough trouble to ruin the entire structure. Even slight settling causes plaster failure, cracks in floors, pulling away of trim, and in general it may spoil the entire remodeling effect. Radical settlement might possibly cause the structural failure of an entire addition.

Rotting or Decay. The wood structural parts of an addition should not come in contact with the ground. Continued dampness in contact with wood eventually causes rotting or decay, and too much

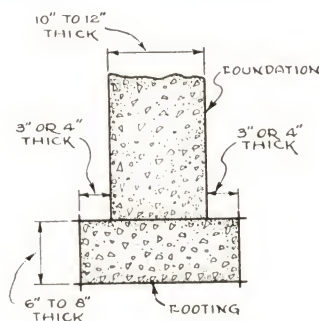


Fig. 123. Typical Footing

of this can cause failure. Foundations, therefore, should serve as a means of keeping all wood parts above the ground.

Water in Basement. Modern basements are used to a greater extent than ever before, and they must be absolutely dry for health and for maintenance of furniture and general equipment. Good tight foundations and waterproofing can fulfill this requirement.

Purpose of Footings. You will agree that it is easier to push a sharpened stick in the ground than one with a blunt end. In like manner a foundation without a footing is much more likely to settle, in most soils, than when a footing is provided. The purpose of footings is to spread the weight or load on the foundation over a wider area, so as to avoid the tendency of the narrower foundation, without a footing, to sink or settle further into the soil.

Footing Dimensions. In Fig. 123 a typical footing is shown. Most building codes specify footing dimensions, depending on the

type of house. Where no specifications are given in codes, or where no codes exist, the following is recommended procedure.

Two-Story House. With 12-inch foundation extend footings 4 inches beyond foundation on either side and to a depth of 8 inches.

One-Story House. With 10-inch foundation extend footings 3 inches beyond foundation on either side and to a depth of 6 inches.

In soils composed of rock or very hard clays, footings are not required but in all others they are recommended.

Chimney Footings. Footings should be provided under all chimneys because of their great weight. The weight of a chimney can be calculated by multiplying the cubic feet of brick masonry by 120 (the weight of brick masonry to the cubic foot). Once the total weight is known it can be divided by the number of pounds each square foot of soil can support without settling. The answer is the square feet of footing required.

For example, say a fireplace chimney weighs 30,000 pounds and that the soil can support only 3,000 pounds per square foot. Then $30,000 \div 3,000 = 10$ square feet of footing required. Such footings may be 8 to 12 inches thick.

Kinds of Foundations. Either a 1:3:5 mix (concrete composed of one part cement, three parts sand, and five parts stone or gravel) or a 1:2:4 mix is generally used for remodeling additions because the materials are easy to secure, easy to mix, easy to pour, and economical.

Rubble stone, brick, or concrete blocks may be used for foundations if they are cheaper to purchase and erect than concrete.

Design of Foundations. Most municipalities have codes regulating the thickness of various kinds of foundations for one- and two-story houses. Where such codes exist their specifications must be met. The specifications of the Federal Housing Administration may be used where no codes exist. Or, the following general recommendations may be followed:

Concrete

One-story house.....	8 inches
One-and-one-half-story house.....	8 to 10 inches
Two-story house.....	10 to 12 inches

Brick

One-story house.....	8 inches
----------------------	----------

One-and-one-half-story house 8 to 12 inches

Two-story house 12 inches

Rubble

Use 16-inch thickness for any foundation

Concrete Block

One-story house 8 inches

One-and-one-half-story house 8 inches

Two-story house 8 to 10 or 12 inches

Tile

Same as for concrete blocks.

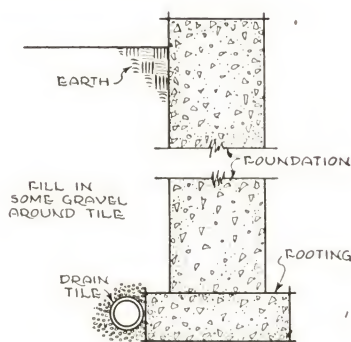


Fig. 124. Drain Tile

When hollow materials such as blocks or tile are used for foundations it is recommended that a cap of masonry work at least 4 inches thick be applied at their tops.

Waterproofing. There are two common ways of making foundations watertight. These methods apply mostly to other than concrete walls, since concrete can be made watertight by adding more cement to the mix.

Plastering. A mortar made of cement and sand can be plastered on the outside surface of foundations to a depth of $\frac{1}{4}$ to $\frac{3}{8}$ inches and this painted with hot asphaltum.

Drain Tile. Drain tile can be run around the outside edge of the foundation near the footing as shown in Fig. 124. When backfilling is done, gravel should be placed around the tile to allow free flow of water to the tile. The tile have no connections and should be placed a slight distance apart to allow water to enter.

When brick or rubble foundations are drained by tile the gravel should constitute practically all of the backfill.

DORMERS. Fig. 125 illustrates a dormer framing of the type most often used in remodeling. The drawing shows this so clearly that no further explanation is needed.

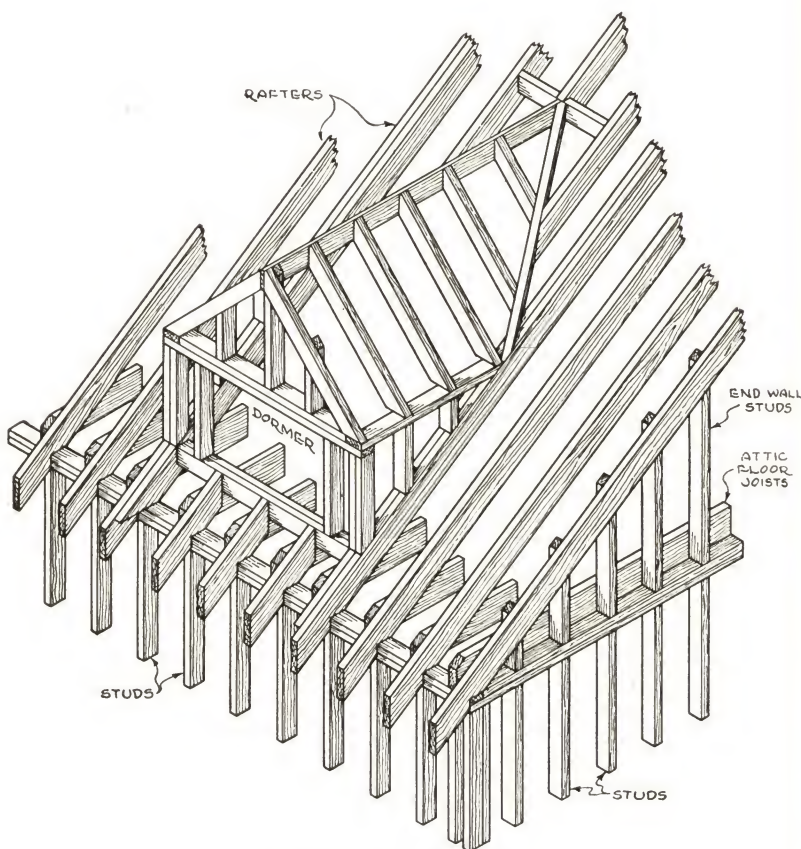


Fig. 125. Typical Dormer Framing

TILE FLOORS. Tile floors are frequently part of remodeling operations. Fig. 126 shows a section of a typical tile floor.

If old bathroom floors are to be tiled the old flooring should be removed and the joists pointed. The cleats and flooring are

applied as shown in Fig. 126. Reinforcing wire should be used over joists, to prevent cracking.

Where bathroom floor tiling is part of a new addition the construction is the same.

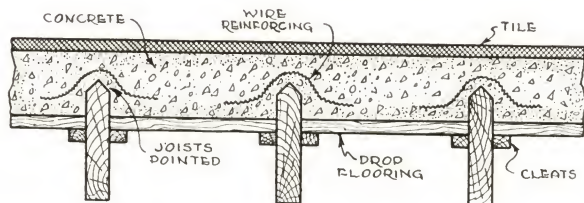


Fig. 126. Section of Typical Tile Floor



A HOUSE IN THE GEORGIAN TRADITION, WITH MODIFICATIONS
Courtesy of Curtis Companies, Incorporated, Manufacturers of Curtis Woodwork, Clinton, Iowa

CHAPTER VIII

Stairs

THE location, design, and installation of stairs are among the most important considerations in any remodeling job whether partial or complete. Stairs should be beautiful, for that beauty adds one of the major ornamentations to a house. They should be economical and in keeping with the total cost of the house or its remodeling. They should be free from hazard, either actual or mental. They should be easy and untiring to climb. They should be well lighted, and located to advantage in relation to their construction and to living space.

In order properly to consider stairs, you must be able to visualize them—their location, appearance, and the structural parts composing, or related to, them. In this chapter, stairs are illustrated and explained in sufficient detail so that you can make preliminary plans for them, as an aid to the carpenter, to the dealer supplying the millwork, and to the stair builder who is to make the installation.

STAIR DETAILS. Everyone is familiar with the general appearance of stairs, but few can visualize the details which compose them. First of all, then, the commonly used details must be illustrated and explained.

Framing. Stairs, like any other part of a house, must be supported by the general framing members. The joists, studs, flooring, and special double-framed members, all serve this purpose.

Study Fig. 127. This illustration shows the typical framing used on ordinary stairs.

The house of which this framing is a part consists of two stories, plus basement and attic. There are stairs from the basement to the first floor, from the first to the second floor, and from the second to the attic floor.



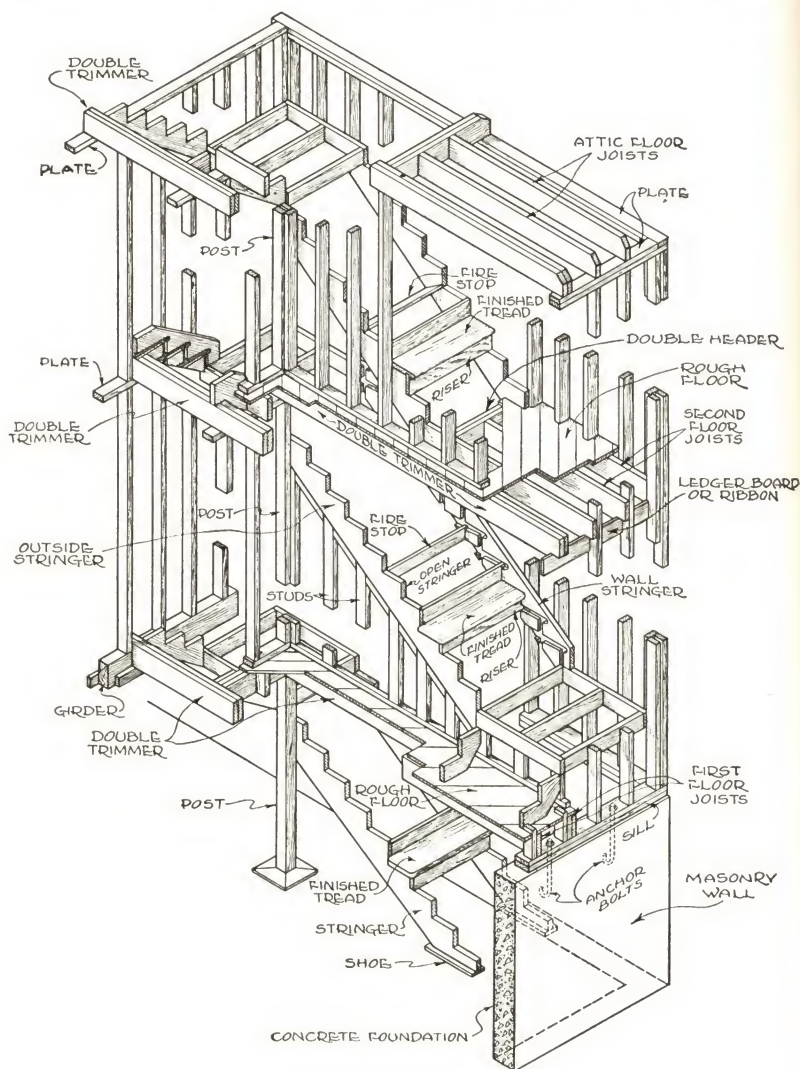


Fig. 127. Stair Framing

The stairs start in the basement, near the word *shoe* in Fig. 127, and the upward stretch is shown by the alternate vertical and horizontal notches cut in the long piece of planking. The stairs extend nearly to the first floor, where there is a landing. From the landing the stairs turn left and continue to the first-floor level.

On the first floor the stairs start near the specification *rough floor* and go up a short distance to a platform. From the platform the stairs turn left and continue upward to the landing near the second floor. Then they turn left again for a short distance, to reach the second floor.

The attic stairs can be traced in like manner.

Note that the stairways are built one over the other so that no space is wasted. Unless stairs are designed and built somewhat in this manner a considerable area is deducted from the living space.

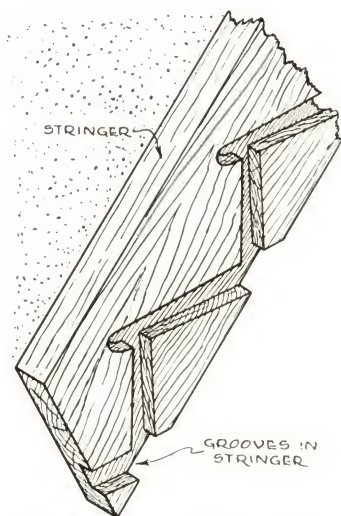


Fig. 128. Grooves Cut in Stringer Next to Walls

Column. The column (marked *post* in Fig. 127) is used to support the double framing around the first-floor stair opening. Columns are the best means of support for flooring near a stair opening.

Double Framing. Notice the double joists, or *trimmers*, around the stair openings on all floors. This follows the recommendation in Chapter VII.

Stringers. Stringers are notched planks, as shown in Fig. 127. These are made from planks such as 2x10's. Sometimes, one side of the stairs is up against a wall, as in the stairs going from first to second floor in Fig. 127. In such cases the stringer next to the wall may have grooves cut in it, as shown in Fig. 128, instead of the verti-

cal and horizontal cuts as in the first to second floor outside stringer in Fig. 127. Or, both stringers may be notched as shown for the attic stairs in Fig. 127.

Treads and Risers. The parts of stairs which one steps on are called *treads*. The vertical pieces between the treads are called *risers*. These are shown in Fig. 129. Notice that the treads are applied to the horizontal notches or grooves in the stringers (see Figs. 127 and 129), while the risers are applied to the vertical cuts or notches.

The *nosing* of a stair is that portion of the tread which extends beyond the riser. The return nosing goes along *AB* in Fig. 129.

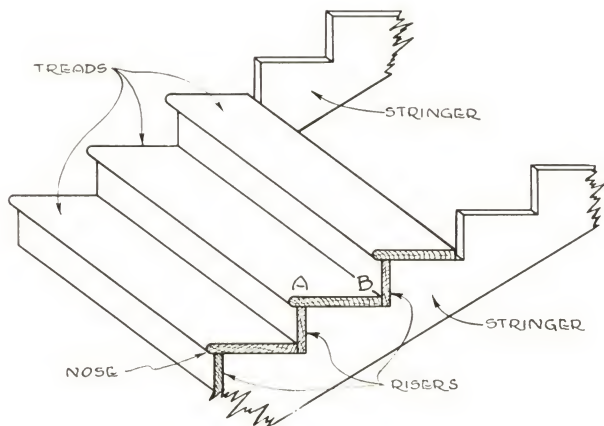


Fig. 129. Parts of a Stairs

Fig. 130 shows typical modern stairs which should be studied in order to understand and visualize Figs. 127 to 129.

Standard Millwork. Standard millwork consists of items, such as stair parts, which are made up and kept in stock by various mills. It is more economical to design a stair using standard millwork. Fig. 130 is composed entirely of standard parts. Fig. 131 shows a typical standard millwork sheet taken from a mill's general catalog. Here various parts of the stairs are illustrated and explained. Most woodworking mills have general catalogs, in which the parts for stairs are listed and illustrated. You can secure such catalogs from building material dealers, or directly from the mills.

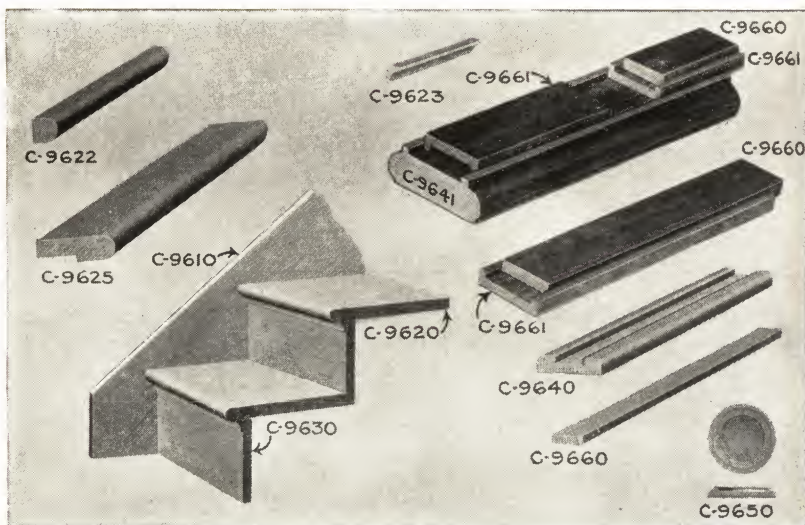
KINDS OF STAIRS. There are a great many kinds of stairs, ranging from the simple unadorned types used in inexpensive cottages to the elaborate and very costly stairs of expensive homes. Old houses in the medium-price field, where remodeling is most likely and most worth while, usually have stairs which belong to a group that might be called *commonly used kinds* of stairs. Elaborate stairs are far out of proportion in cost to other ordinary remodeling expense, and for that reason they will not be considered here.



Fig. 130. Typical Modern Stairs
Courtesy of Curtis Companies, Inc., Clinton, Iowa

Straight Stairs—Open String. Fig. 132 shows a straight run stairs. This stairway is all in a straight line, extending from one floor to the next without landings or turnings. It is called *open string* because one of the stringers is visible, as in Fig. 130.

Advantages. This kind of stairway is economical to build because all parts can be selected from standard millwork, and because the installation and framing are not difficult. It can be made very beautiful, somewhat as shown in Fig. 130, by careful selection of the vari-



Star indicates woods in which items are usually stocked

	W. P. Pine	Yellow Pine	Plain Oak	Unsel. Birch
C-9610 Stringer $\frac{3}{4}$ "x11".....	★	★	★	★
Shipped S4S unless ordered molded to match room base. Order should specify design to be matched.				
C-9620 Tread, $1\frac{1}{32}$ "x10 $\frac{1}{2}$ "x3' 5" long.....	★	★	★
C-9620 Tread, $1\frac{1}{32}$ "x10 $\frac{1}{2}$ "x3' 11" long.....	★	★	★
C-9620 Tread, $1\frac{1}{32}$ "x11 $\frac{1}{2}$ "x3' 5" long.....	★	★	★
C-9620 Tread, $1\frac{1}{32}$ "x11 $\frac{1}{2}$ "x3' 11" long.....	★	★	★
Treads are nosed front edge. Not tongued or grooved.				
Mitered returns may be had if desired, applied to treads. Dovetailed for Balusters, if so ordered.				
C-9622 Loose Returned Nosing, $1\frac{1}{32}$ "x1 $\frac{1}{8}$ "x1' 4".....	★	★
C-9623 Cove Mold $1\frac{1}{2}$ "x $\frac{3}{4}$ ".....	★	★	★	★
C-9625 Landing Tread (nosed and rabbeted for $\frac{13}{16}$ " flooring) $1\frac{1}{32}$ "x3 $\frac{1}{2}$ ", 3' 5" or 3' 11".....	★	★
C-9625 Landing Tread.....	★	★	★
C-9630 Riser, $\frac{3}{4}$ "x7 $\frac{1}{2}$ "x3' 5".....	★	★	★	★
C-9630 Riser, $\frac{3}{4}$ "x7 $\frac{1}{2}$ "x3' 11".....	★	★	★	★
C-9630 Riser, $\frac{3}{4}$ "x8" x3' 5".....	★	★	★	★
C-9630 Riser, $\frac{3}{4}$ "x8" x3' 11".....	★	★	★	★
Risers are cut to size but not plowed.				
C-9640 Shoe, $\frac{3}{4}$ "x2 $\frac{1}{2}$ ".....
C-9041 Shoe, $1\frac{1}{16}$ "x3 $\frac{7}{8}$ ".....	★	★	★
C-9650 Rosette, 5" diameter.....	★
C-9650 Rosette, 6" diameter.....	★
C-9660 Fillet, $\frac{3}{8}$ "x1 $\frac{3}{8}$ ".....	★	★	★
C-9661 Fillet, $\frac{3}{8}$ "x1 $\frac{5}{8}$ ".....	★	★	★
C-9661 Fillet, $\frac{7}{16}$ "x2".....	★	★	★

This stair material is also available in American Walnut

Fig. 131. Typical Sheet from a Woodwork Catalog
Courtesy of Curtis Companies, Inc., Clinton, Iowa

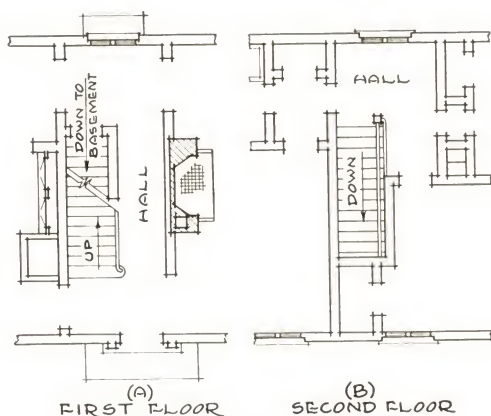


Fig. 132. Straight Stairs with Open String

ous parts, and by the use of good taste in painting, finishing, and the choice of the runner (carpet).

When houses are being remodeled along Colonial lines where a central hall is necessary on both first and second floors, this type of stairway can be used to good advantage as indicated in Fig. 132. Or where new stairs are to be put at one end of a living room, with open string, the straight kind can be used to advantage.

Disadvantages. The fact that these straight run stairs have no landings makes them somewhat tiring to use, especially for older people. This is particularly true in old houses, where the distance between first and second floors is more than 9'0".

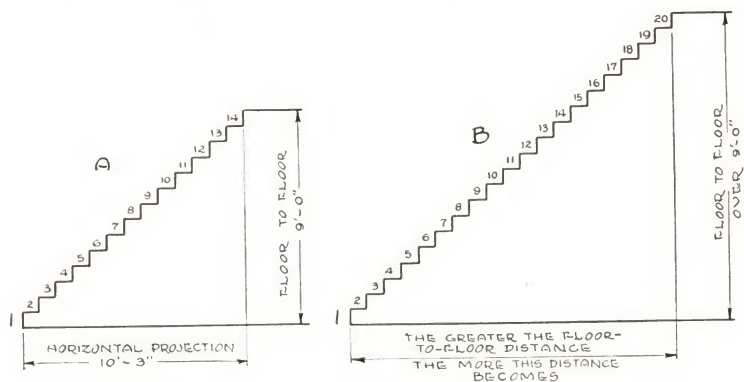


Fig. 133. Horizontal Projection

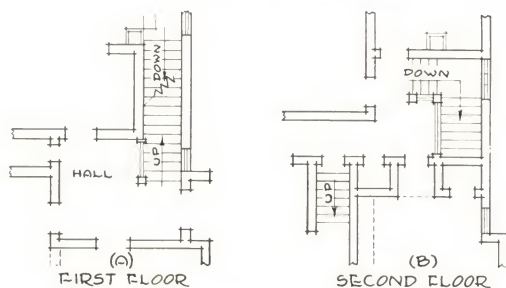


Fig. 134. L Stairs

Also, in the older houses with higher ceilings the use of this kind of stairway requires a great deal of floor space. Note Fig. 133. At *A* a rough sketch shows a straight stair where the distance between floors is 9'0", and a recommended height of riser is used. Notice that the horizontal projection, or floor space required, is 10'3". At *B* the sketch shows how the horizontal projection increases in length as the distance between floors becomes greater.



Fig. 135. Typical L Stairs

Courtesy of Curtis Companies, Inc., Clinton, Iowa

Straight Stairs—Closed String. Straight stairs may be used also where both strings are closed, *closed string*. In such a case the stairs would be between two partitions.

Long L Stairs. Fig. 134 shows **L** stairs, shaped, as the name implies, somewhat like an **L**. The sketch at *A* in Fig. 134 shows part of the stairs going to the second floor, and part going to the basement. At *B*, the top part of the stairs is shown, as it approaches and reaches the second floor. The square landing is the point where the change of direction takes place.

Fig. 135 shows a typical installation of **L** stairs.

Advantages. The principal advantages for these stairs are that they do not require as much floor space (horizontal projection) and that they have a landing, or resting place.

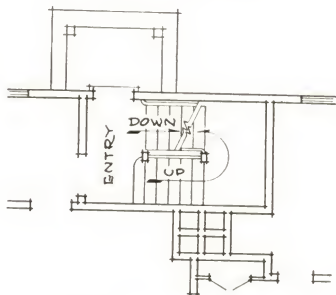


Fig. 136. Typical **U** Stairs

Disadvantages. Ordinarily, in order to have natural light, **L** stairs must be located next to an outside wall in which a window is located. These stairs are more costly than the straight stairs, due to their requiring more parts, more installation labor, and more intricate framing.

Double L Stairs. Double **L** stairs are indicated in Fig. 127 between the first and second floors. Here there are two landings. This requires less floor space, and also makes the stairs less tiring. The disadvantages are that they require even more parts than the **L** stairs, involve more labor, and must be located against an outside wall.

Narrow U Stairs. Fig. 136 shows a typical **U** stairs. These stairs are often used near a front entrance, or near the rear wall of a house. As with other ordinarily used types, the basement stairs can be made in the same opening.

Advantages. **U** stairs have the decided advantage of taking up little floor space. They therefore work out exceptionally well in remodeling, because often they can be constructed in an area formerly assigned to pantry, breakfast nook, or large closet. The landing about midway up makes a convenient resting place, and allows good natural lighting. This type works out better where the stairs are designed primarily for use, rather than for beauty or ornamentation, as in a living room.

Disadvantages. The disadvantages, as compared with straight

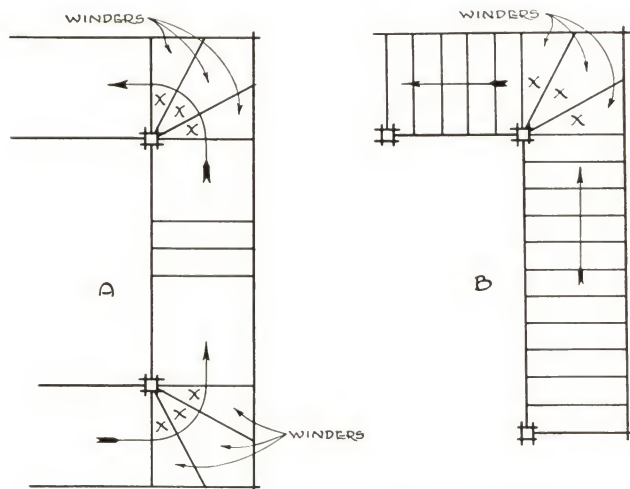


Fig. 137. Double **L** (at A) and **L** (at B) Stairs with Winders

stairs, are the added number of parts, more expensive railings and newels, more intricate framing, and additional labor time.

Stairs with Winders. Fig. 137 illustrates double **L** and **L** stairs which have *winders*. These stairs are often found in old houses, but if possible they should be avoided in remodeling.

Advantages. The winders make it possible to put the stairs in a smaller space (less horizontal projection) than when landings or straight stairs are used.

Disadvantages. The winders constitute a hazard, both mental and actual, so that such stairs are somewhat unsafe. The X's in Fig. 137 indicate the points where the treads of winders become very narrow. Unless people are careful to keep to the center, tripping or fall-

ing is easily possible. For stairs to be entirely safe, treads and risers should be exactly uniform in size. If winders are entirely unavoidable, as is sometimes the case in remodeling work, then they are better placed near the bottom of the stairs, so that a fall would not be likely to be so serious.

WIDTH OF STAIRS. For ordinary purposes, stairs should be at least 3'0" wide. The best width is between 3'0" and 3'6". Stairs narrower than 3'0" are inconvenient when furniture must be moved up or down, or when two people attempt to pass on the stairs. In addition, they are not so attractive in appearance.

The most important consideration when deciding upon the width for stairs is the carrying of furniture up and down them. The type of furniture which may have to be moved should therefore be considered, and stairway widths determined accordingly.

DESIGN OF STAIRS. The design of stairs is very properly the job of an expert, such as a stair builder or the agent of a woodworking mill. However, you should have some general understanding of the principles in order to select the proper location, lay out the floor area required, determine the number, size, and kind of treads and risers, and select the other millwork; in other words, take care of everything but the actual designing of the stairs. When these preliminary matters have been determined, then an expert on stair designing should be consulted.

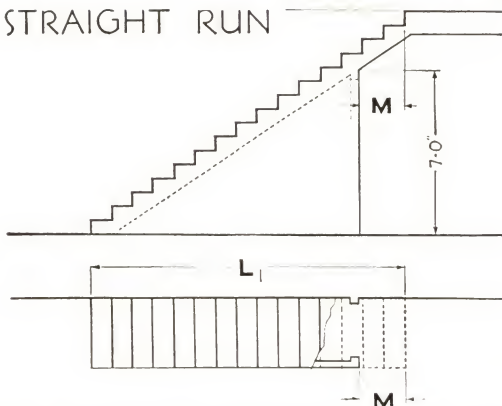
Treads and Risers. The width of a tread must be greater than the height of a riser. Three rules frequently followed in designing inside stairs are as follows:

1. The product obtained by multiplying the height of the riser (from tread to tread) in inches, by the width of the tread (from face to face of risers) in inches should be between 70 and 75. Thus either a 10-inch tread and a 7-inch riser, or a 9-inch tread and an 8-inch riser would be acceptable.

2. The sum obtained by adding the width of one tread and the height of one riser should be 17 to 18. A 10-inch tread and a riser from 7 to 8 inches high, or an 11-inch tread and a riser from 6 to 7 inches high would be acceptable according to this rule.

3. The sum of 2 risers and 1 tread should be between 24 and 25. Thus a 7- to 7½-inch riser with 10-inch to 11-inch tread would be acceptable.

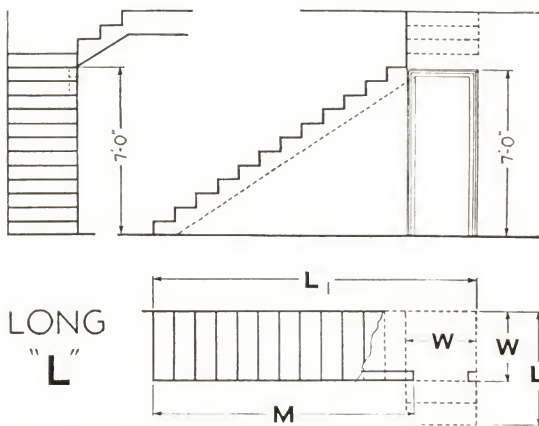
STRAIGHT RUN



Height Floor to Floor	No. of Risers	Riser	Tread	L ₁	M
8'-0"	13	7.38	10 $\frac{1}{4}$ "	10'-3"	
8'-6"	14	7.29	10 $\frac{1}{2}$ "	11'-4 $\frac{1}{2}$ "	4 $\frac{1}{2}$ "
9'-0"	15	7.20	10 $\frac{1}{2}$ "	12'-3"	1'-1 $\frac{1}{2}$ "
9'-6"	16	7.13	10 $\frac{3}{4}$ "	13'-5 $\frac{1}{4}$ "	1'-11 $\frac{1}{4}$ "

Fig. 138. Dimensions for Straight Run Stairs

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Height Floor to Floor	No. Risers	Riser	Tread	No. Risers	L ₁	No. Risers	L ₂	M
8'-0"	13	7.38	10 $\frac{1}{4}$ "	13	10'-3"+W	0	W	10'-3"
8'-6"	14	7.29	10 $\frac{1}{2}$ "	13	10'-6"+W	1	W	10'-6"
9'-0"	15	7.20	10 $\frac{1}{2}$ "	13	10'-6"+W	2	10 $\frac{1}{2}$ " + W	10'-6"
9'-6"	16	7.13	10 $\frac{3}{4}$ "	13	10'-9"+W	3	1'-9 $\frac{1}{2}$ " + W	11'-0"

Fig. 139. Dimensions for long L Stairs

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Figs. 138 through 141 show diagrams and tabular material which will simplify the task of designing stairs. The width, W , must be determined independently, to suit the circumstances under which the stairs will be used. L_1 indicates the length, in plan or horizontal projection. L_2 shows, in plan at right angles to L_1 , the width required when the stair is **L** or **U** shaped. The letter M shows the distance which is required to allow a 7-foot door to be placed under the stairs, for access to a closet or other opening.

Head Room. When two or more flights of stairs are constructed one above the other as shown in Fig. 127, care must be taken to make

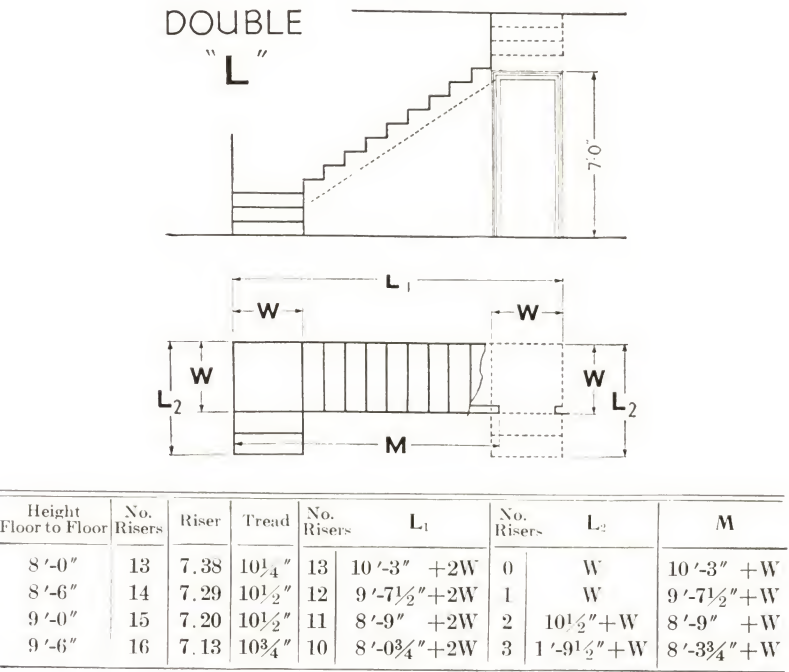
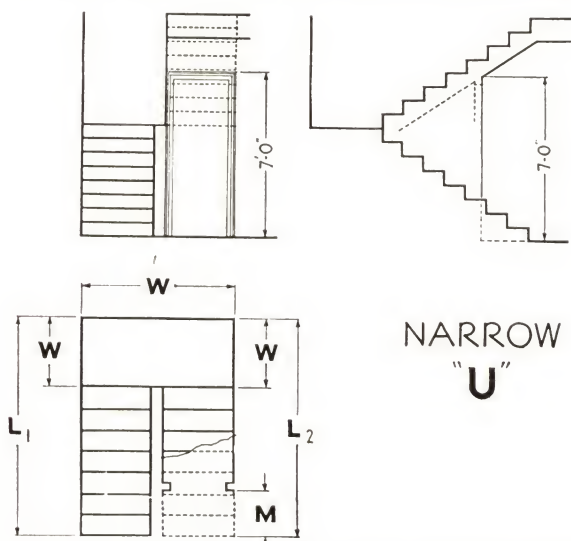


Fig. 140. Dimensions for Double L Stairs
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sure there is sufficient room between stairs so that people of average height can walk up or down them without bumping their heads, or being afraid that they might do so. The space, or vertical clearance, required is called *head room*. Note Fig. 142. The distances marked Y indicate head room. Suppose a person were going from first to

second floor. At *A*, in Fig. 142, the head room must be sufficient to allow starting up the stairs without even the fear of striking one's head. And all the way up the stairs, as for instance at *B*, as much or more head room must be maintained.

In designing stairs, sections should be drawn accurately to scale in order to be absolutely sure that sufficient head room is allowed. For main stairs at least 7'6" of head room is recommended.



Height Floor to Floor	No. Risers	Riser	Tread	No. Risers	L_1	No. Risers	L_2	M
8'-0"	13	7.38	$10\frac{1}{4}"$	7	$5'-1\frac{1}{2}" + W$	6	$4'-3\frac{1}{4}" + W$	.....
8'-6"	14	7.29	$10\frac{1}{2}"$	7	$5'-3" + W$	7	$5'-3" + W$	$4\frac{1}{2}"$
9'-0"	15	7.20	$10\frac{1}{2}"$	8	$6'-1\frac{1}{2}" + W$	7	$5'-3" + W$	$1'-11\frac{1}{2}"$
9'-6"	16	7.13	$10\frac{3}{4}"$	8	$6'-3\frac{1}{4}" + W$	8	$6'-3\frac{1}{4}" + W$	$1'-11\frac{1}{4}"$

Fig. 141. Dimensions for Narrow U Stairs
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ILLUSTRATIVE EXAMPLE. In this example it is assumed that an old one-story brick cottage, containing four small rooms, is being remodeled to have two stories, and to contain a basement, a large living room, a dining room, kitchen, utility room, garage, three bedrooms, a bathroom, and closets.

Fig. 143 shows a rough sketch of the original main walls and dimensions of the cottage. We will assume that partition *A* must stay as it is because of the supporting girder and column in the basement.

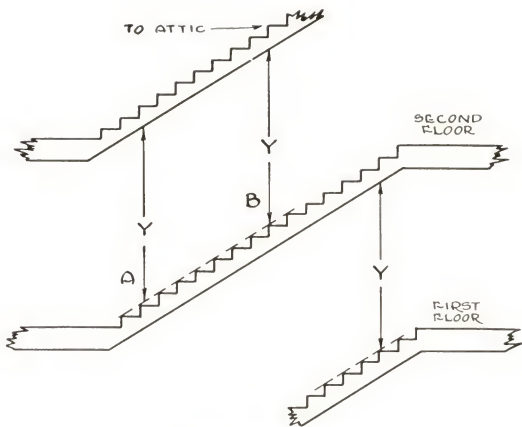


Fig. 142. Head Room

Fig. 144 shows the addition made to the first floor, providing space for a garage and utility room. Note that the old partition A was retained in laying out the kitchen, dining room, and living room. Fig. 145 shows the arrangement of the new second floor, designed so as to use partition A as a bearing partition.

The arrangement and size of all rooms on both floors, based on the use of partition A, have worked out satisfactorily except that no stairs have been provided for, and there is no coat closet anywhere near the living room. The stairs, of course, are the main problem.

From a study of Fig. 144 we see that there is no possibility for the stairs to the second floor to be in the kitchen or dining room, because the horizontal projection would require too much floor space. Therefore, the stairs must be in the living room.

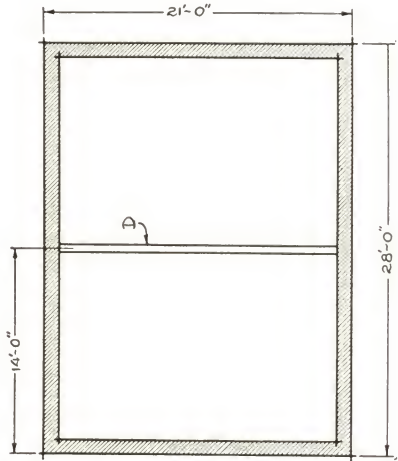


Fig. 143. Rough Sketch of Main Walls of Old House

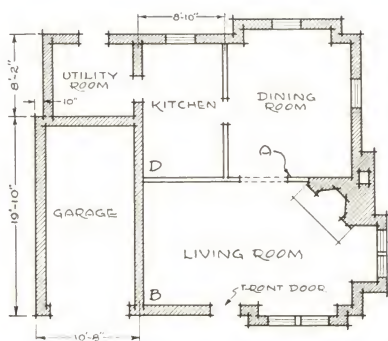


Fig. 144. Remodeled First-Floor Plan

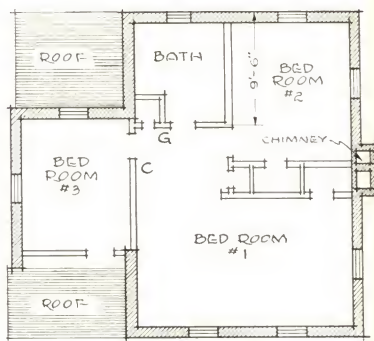


Fig. 145. Remodeled Second-Floor Plan

The right side of the living room contains a fireplace and a bay for windows, so there is no chance of placing the stairs on that side. The front of the living room also has a window bay, while the third wall contains the archway into the dining room. Therefore only the left side of the room remains.

Studying that side of the living room we see that the wall is up against the garage and therefore has no windows. Studying the second floor we find that there is a central hall space upon which all rooms open. Thus, if a stair started at *B* on the first floor and ended about at *C* on the second floor it would be centrally located on the second floor, and conveniently out of the way in the living room; indeed it would be a means of ornamentation to the living room.

The basement stairs could start about at *D* on the first floor and run underneath the main stairs.

To check the feasibility of the stair situation thus far reasoned out, we must make some actual calculations. Assume the distance from the first floor to the second is 9'0". Then turn to Fig. 138 and note that for a 9'0" floor-to-floor distance, 7.20-inch risers and 10½-inch treads are recommended. The horizontal projection would then be 12'3".

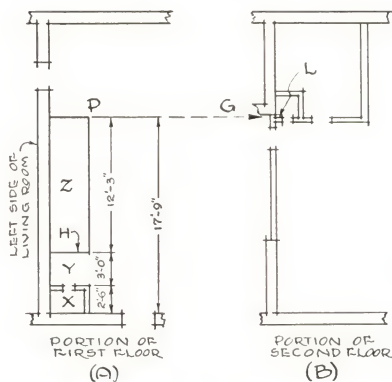


Fig. 146. Testing for Location of Stairs

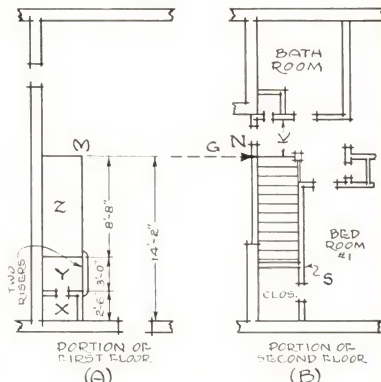


Fig. 147. Second Test for Location of Stairs

Now note Fig. 146 at *A*. This portion of the first floor shows the left wall of the living room. At *X* a small coat closet has been drawn in. At *Y* is a 3'0" space between the first riser, *H*, and the closet door. The space at *Z* is 12'3" and represents the horizontal projection of a straight stair of recommended riser and tread dimensions. This seems to work out satisfactorily as far as the first floor is concerned.

To check the stairs for the second floor, draw a portion of the second floor as shown at *B* in Fig. 146, lining up front and rear walls with *A*. From the point *P*

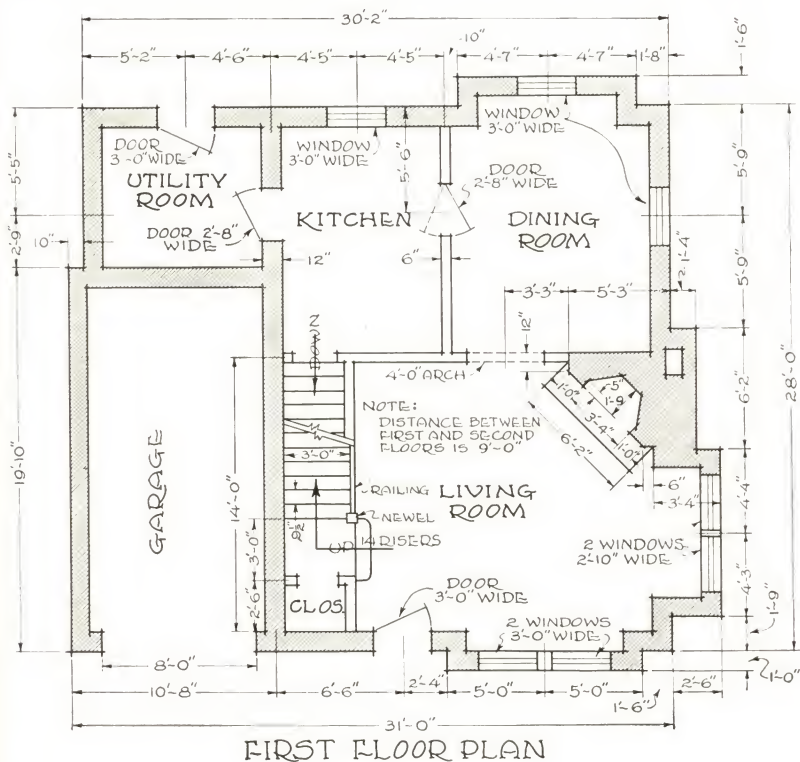
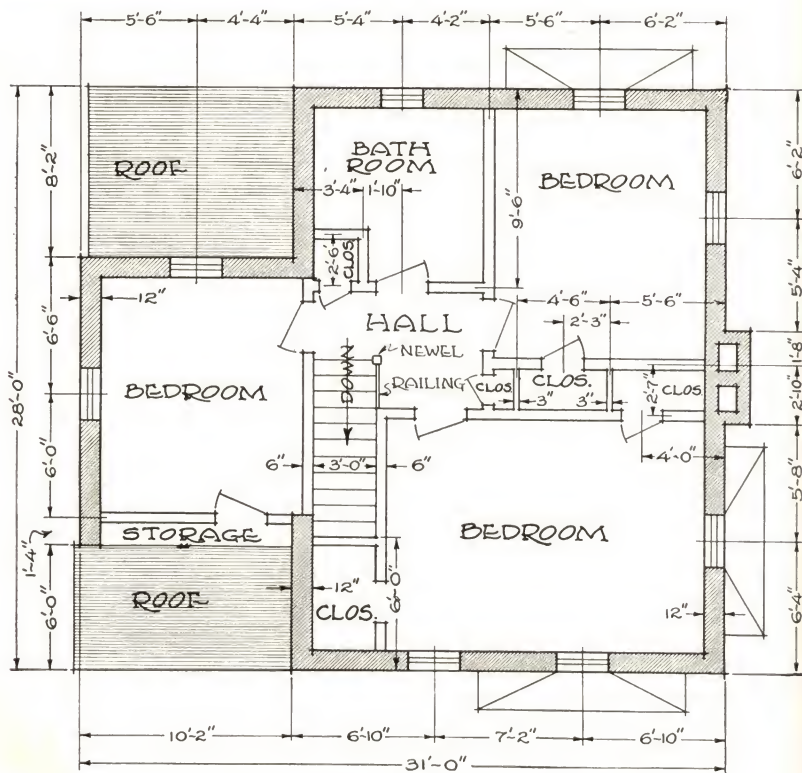


Fig. 148. First-Floor Plan

draw a line, as indicated by dotted line and arrow *G*. This shows that the top of the stairs would come right up against partition *L*. It is not advisable to move this partition, so another idea must be worked out for the stairs.

Consider a narrower tread and a higher riser, following about the same layout as shown in Fig. 146. The risers can be increased $\frac{1}{2}$ -inch in height, or from 7.20 to 7.70. Then in a distance of 9'0" there would be $108''$ divided by 7.70, or 14 risers. Then cut down the tread width from $10\frac{1}{2}$ to $9\frac{1}{2}$ inches. If there are 14 risers there will be 13 treads and $13 \times 9\frac{1}{2} = 123.50$, or $123\frac{1}{2}$ inches. Then $123\frac{1}{2} \div 12 = \text{approximately } 10\frac{2}{3}''$ of horizontal projection.

Now suppose two risers are put at the bottom of the stairs, as shown at A in Fig. 147, so that the 3'0" space at Y becomes a landing two risers above floor level. This would give the space Z 12 risers instead of 14, and also there would be two less treads. Each tread is $9\frac{1}{2}$ inches. Then two treads make 19 inches, or 1'7", which subtracted from 10'3" leaves 8'8". Thus the horizontal projection (space Z) need only be 8'8" long.



SECOND FLOOR PLAN

Fig. 149. Second-Floor Plan

Drawing a line over from *M* to *N*, represented by arrow *G*, as explained for Fig. 146, we see that the top of the stairs comes so as to leave a distance, *K*, between it and the bathroom wall in Fig. 147.

A closet can be built over the stairs, as shown at *B* in Fig. 147, to provide additional storage space for bedroom 1.

Figs. 148 and 149 are regular working drawings showing our final arrangements for the stairs.

The basement stairs, as shown in Fig. 148, start in the kitchen and are under the main stairs. No attic stairs are required.

To check whether sufficient head room has been allowed, we might draw a section of the stairs, such as Fig. 150. This section was drawn as though spaces *X*, *Y*, and *Z* in Fig. 147 were cut through the center, parallel to the left wall of the house. Thus starting at the left side of Fig. 150 we see the outside wall, the cloak closet, the cloak closet door, the 3'0" landing, and the stairs.

To lay out the risers and treads, make a vertical row of dots, and a horizontal row of dots, spaced equal to the riser and tread dimensions. Then draw lines, as indicated in Fig. 150, to form the stair symbol.

We can then scale the head room, *Y*, to see that it is ample.

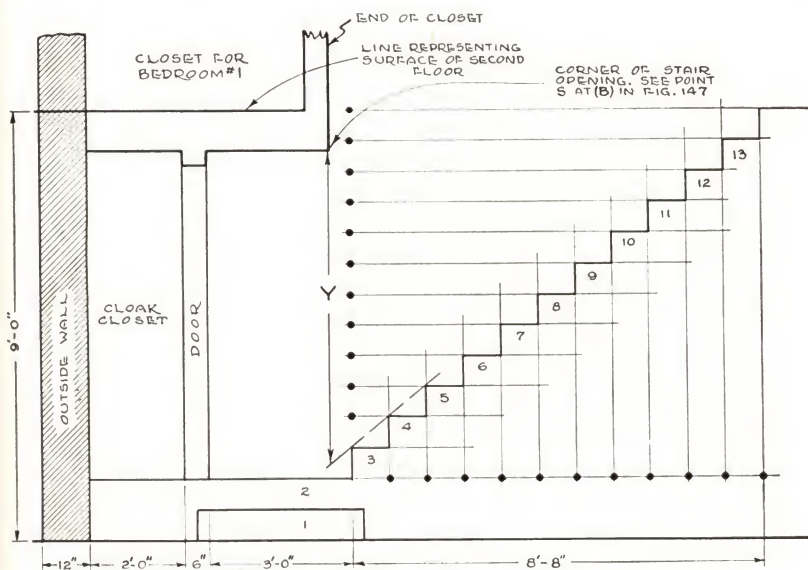


Fig. 150. Testing for Head Room

Conclusion. This process for designing stairs may seem tedious and drawn out, yet if you are not experienced in work with stairs, the full procedure is recommended. Many mistakes are made in relation to stairs which would not have been made if similarly careful attention had been given to their design. Poorly designed stairs will do a great deal to reduce the value and minimize the effects of your remodeling, whereas well-planned stairs will contribute an effect of beauty and sound design.



COTTAGE DESIGNED IN MODIFIED CAPE COD STYLE IN BRICK

Courtesy of Curtis Companies, Incorporated, Manufacturers of Curtis Woodwork, Clinton, Iowa

CHAPTER IX

Insulation

IN PLANNING the remodeling and modernization of houses, one important consideration is the use of insulation. As a matter of fact, many of the comforts and benefits associated with modern houses depend on the proper use of this material. The purpose of this chapter, therefore, is to explain and illustrate insulation, and its principles, so that you will understand how to provide for it when making your remodeling plans, or to check the provisions for it in the plans made by someone else.

WHAT IS INSULATION? Everyone is familiar with certain examples of insulation in everyday life. For instance, the pads used under hot dishes on tables are there to retard or stop the flow of heat from the dish to the surface of the table. This, then, is insulation, used to protect the surface of the table. The wood handles of cooking pans and electric irons are provided because they do not conduct heat as readily as the metal to which they are attached, thus insulating the hands against burning. Steam and hot-air heating pipes are covered, or insulated, to prevent the escape of heat from the pipes to the surrounding air.

Likewise, insulation is built into the structural parts of a house to prevent the escape of heat from the rooms during the winter, and to keep the rooms cooler during the summer. Additional reasons for the use of insulation are explained in succeeding pages.

Insulation used in houses can be grouped into three general classes, *vegetable*, *mineral*, and *metallic*.

Vegetable. This class of insulation uses materials which grow naturally, or other materials which are processed from natural vegetable growths. Cork is an ex-



ample of natural growth, whereas the rigid-board type is an example of material manufactured from natural growths. Wood, sugar cane, and corn stalks are some of the natural growths used in the manufacture of insulation.

All of these materials, whether natural growth or manufactured from natural growth, have one quality which makes them resistant to the passage of heat through them. Their structure is composed of millions of minute air pockets in which the air is "dead" or, in other words, not moving. When air is thus confined, it does not transmit heat. Consequently, if board-form insulation is made up of such material, heat reaching one side will not readily be conducted through to the other side. This material, therefore, is very suitable for insulating houses.

Mineral. Fill-type insulation is manufactured from various minerals. In this class, the manufacturing process itself creates millions of air pockets which act to prevent the flow of heat.

Metallic. In this insulation, metals such as aluminum and steel are processed into thin sheets having bright or shiny surfaces. The insulation principle here is based on the heat being reflected back from the material. Thus heat reaching one side of a sheet of such material would not readily travel to the other side, because of the tendency of the bright surface to reflect back the heat.

Non-Insulating Materials. Iron, unprocessed steel, and other heavy metals have no insulating value because their structure is dense and does not provide for air pockets. Thus heat travels through such materials very readily. Wood has some insulating value, because its structure, as a rule, is not very dense. For this reason it can be used for handles on metal objects which are subject to heat, but it is not considered a good material for the insulation of houses. Concrete, brick, and stone have no appreciable insulation value because of the density of their structure, with consequent lack of air pockets. Plaster is not a good insulator, because its structure, too, is quite dense.

Aluminum and steel have great insulating value when manufactured into thin sheets, as previously explained, but none whatever when they are of an appreciable thickness.

For any material to have insulation value, its structure must be light in weight, and either it must contain a great number of air pockets, or it must have the bright surfaces of the metallic class of

insulation materials. The general principle, then, of insulating materials is that by one means or another they have the ability to retard or resist the flow of heat. The many kinds of insulation are explained in succeeding pages.

Example. Suppose a bar of iron one inch in diameter and two feet long, and a bar of cork of the same dimensions, could be placed so that one end of each was in a flame. The bar of iron would soon become too hot to handle throughout its length, whereas the bar of cork could be handled with ease. The cork would burn slowly from the end exposed to the flame, but, until it was consumed, the other end would not become too hot to handle.

This example explains the difference between materials which have, and those which have not, insulating qualities. Iron, with its dense structure and no air pockets, conducts heat readily, whereas cork, with millions of air pockets, does not conduct any appreciable amount of heat.

WHY INSULATION IS USED. There are many reasons for using insulation in the remodeling of houses, some of the more important of which are explained in the following paragraphs.

Lower Fuel Costs. If any house, new or old, is not insulated at the proper places, so much of the heat supplied by the heating system is lost through walls and ceilings that the heating plant requires an almost constant supply of fuel or an oversized heating unit. This means tedious and excessive firing, as well as the use of an unnecessarily large amount of fuel.

Few of the conventional building materials have any ability to stop the flow of heat from the inside of houses to the outside. As a result, a great deal of the heat that is supplied to the various rooms escapes to the outdoors. This process incurs a considerably larger loss in fuel, even through one heating season, than most people imagine.

A properly insulated house, on the other hand, prevents much heat from escaping, with the result that less fuel is required to maintain a comfortable and even temperature.

The United States Bureau of Standards gives the following approximate yearly savings in fuel when houses are properly insulated. These savings are expressed in percentages of fuel which would have been required for a house similar in size, but without insulation or any other means of preventing heat loss.

If one-half inch of some form of good insulation is used in side walls and roof, the saving is 20 to 30 per cent.

If one inch of like insulation is used, the saving is 30 to 40 per cent.

These figures are, of course, approximate, but they give a good indication of the savings in fuel, which insulation makes possible in remodeled houses. On the basis of fuel savings ranging from 20 to 40 per cent, the cost of the insulation is covered in a comparatively short time, after which the yearly saving in fuel is a real gain. In the colder portions of the country, and where fuel is expensive, insulation is a major economy.

Smaller Heating Systems. For houses that are being remodeled and modernized, new heating systems, with all the benefits of modern heating equipment, usually are a first consideration. From this angle, also, proper insulation is important.

As explained fully in Chapter XIII, it is necessary actually to calculate the heat losses per hour from a house before a heating system can be selected intelligently. In other words, heating systems vary in size, depending on the volume of heat they must produce per hour.

Therefore, the use of insulation, reducing the heat loss per hour, also reduces the cost of the heating system, because a smaller system can be used effectively. Thus we see that insulation not only saves on fuel costs, but actually saves on the cost of this equipment.

If a new heating system is not planned as part of a remodeling job, insulation will still save fuel costs and make possible a larger volume of heat with fewer firing periods.

Moreover, properly planned installation might be the factor which would permit the old heating system to be retained, even if one or more rooms were to be added, because with insulation the total heat loss, including the added area, would probably not be any more than the heat loss for the smaller area without insulation.

Winter Comfort. Real bodily comfort is more readily assured with proper insulation, because even temperatures, without drafts, can be maintained. By retarding the rate of heat loss, insulation makes possible an even temperature which cannot be maintained in old houses where no insulation is used. Also, very high humidity maintained in an uninsulated house would be apt to mean danger of

condensation. However, proper insulation and moisture barriers would lessen the danger of condensation.

Tests made at the University of Illinois' experimental station indicate that with the same room temperature in two houses, one with proper insulation and the other without, the body has a greater sensation of comfort in the insulated house.

Summer Comfort. In the summer, especially in the warmer parts of the country, temperatures on roofs of houses range up to 140° or higher. The temperatures of the walls are not so much less. If the house is not insulated, much of this intense heat is absorbed by the mass of the structure. This makes the house, and particularly the upper-floor rooms, uncomfortably warm both day and night. Even after sundown, when the outside air grows cool, the upper rooms stay excessively warm, due to the slow release of the heat stored in roofs and walls.

Roof and side-wall insulation of the proper kind, and properly installed, will greatly reduce the discomfort in houses during the summer. Insulation keeps the heat out in summer as effectively as it keeps it in during the winter. Temperatures 10° to 15° lower are maintained during the summer in houses which are well insulated, and this without the aid of any cooling devices.

Air Conditioning. If a house is to be equipped with winter or summer air conditioning, or both, insulation is an absolute necessity, from the standpoint of economy and of operation.

In winter air conditioning, the air is heated, humidified, and cleaned. The savings on heating where insulation is used have already been noted, both as to fuel and equipment. Air-conditioning equipment is more costly, so the savings are even greater.

Air conditioning in summer consists of cooling, dehumidifying, and cleaning the air. Without the use of insulation, the cost of cooling equipment and of its operation would be almost prohibitive. Also without insulation the cooling would be found unsatisfactory and would fall below the requirements.

In air-conditioned homes the air is recirculated to a great extent. This is an economy, both in winter and in summer, because air returned from the rooms requires less reheating, or recooling, than if air from outside were constantly admitted. This is especially true of summer cooling. Insulation makes this recirculation economical.

Sound Insulation. Fortunately, the same insulation used to resist heat flow also serves the further purpose of reducing undesirable noise, both from within and from the outside of the house.

TYPES OF INSULATION. Under the three general classes of insulation previously mentioned and explained, a great many individual types are manufactured. It is well to become acquainted with



Fig. 151. Type of Fill Insulation

Courtesy of U. S. Gypsum Company, Chicago, Ill.

the most common of these. The insulations herein described are merely illustrative; no preferential recommendation is implied.

Fill Type. There are many kinds of this type of insulation, bearing different trade names. They are made from limestone, sand, glass, slag, flint-rock, or other siliceous minerals. In the manufacture of one kind of fill insulation, the ingredients are melted and thus thoroughly blended. Then the molten mixture flows out of a spout and is blown by a steam jet. The steam transforms the mixture into small globules, which in turn are transformed into a "woolly" material containing millions of minute dead-air pockets. These air pockets, as previously explained, give the material its insulating efficiency. Fig. 151 shows

a typical fill-type insulation. Ordinarily this material may be purchased in different sized bags.

Blanket Type. Blanket insulations are manufactured from various kinds of fill-type material, such as *Zostera marina*, hair, and other substances, all of which are soft and flexible. These insulating materials are covered by Kraft paper or similar wrappings. Blankets can be secured in varying thicknesses, widths, and lengths. Other insulations, manufactured on the same principle as these blankets, are called quilts. Fig. 152 shows a typical blanket.

Batt Type. This type of insulation comes in pads usually called "batts." In general these batts are made of some form of fill or wool-like insulation, and they may or may not be covered with a Kraft or



Fig. 152. Blanket-Type Insulation
Courtesy of U. S. Gypsum Company, Chicago, Ill.

similar paper, on one or two sides. Fig. 153 shows an example of batt-type insulation.

Metallic Type. Metallic insulation, one example of which is shown in Fig. 154, consists of very thin sheets of metal which can be mounted on another material. It is used in one or more layers, or curtains, with an air space between each two layers.

Rigid Type. This type of insulation is manufactured from wood, cork, sugar cane, corn stalks, and like materials into panels or planks of various sizes and thicknesses. This material can be sawed, nailed, and cut to any desired shape. In many instances it is used in the place of wood sheathing, lathing, roof boards, or rough flooring. Fig. 155 shows a typical example of rigid insulation.

Pipe Insulation. Many types of insulation are made to fit pipes of various diameters. Fig. 156 shows typical insulation of this kind.

Decorative and Acoustic Insulation. Other kinds of insulation are suitable for wall surfacing and are used in place of plaster.



Fig. 153. Batt-Type Insulation

Courtesy of Johns-Manville Corp., New York, N.Y.

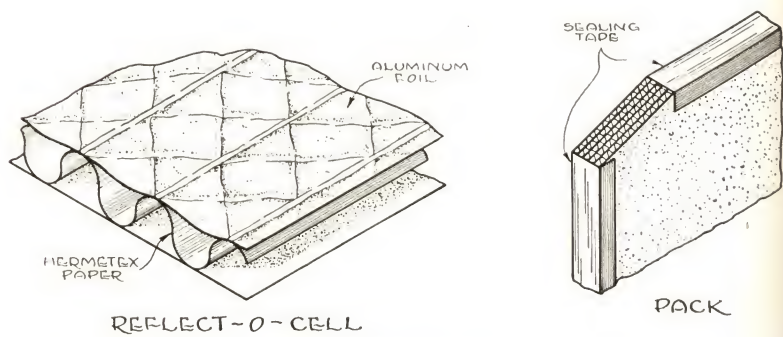


Fig. 154. Metallic Insulation



Fig. 155. Rigid-Type Insulation

Courtesy of The Insulite Company, Minneapolis, Minnesota

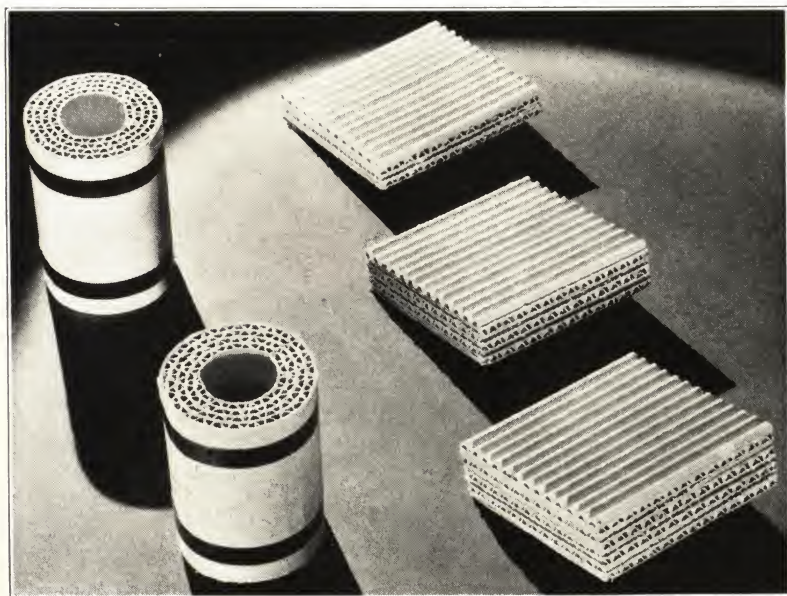


Fig. 156. Typical Pipe Insulation

Courtesy of The Ruberoid Company, New York



Fig. 157. Insulation Used for Interior Wall Surfaces
Courtesy of Wood Conversion Co., St. Paul, Minn.

These types are practical for use in remodeling rooms, especially in attics and basements. This form of insulation can be purchased in all colors, in different sizes and thicknesses, and with a variety of surface treatments. Fig. 157 shows a typical example of such insulation. Ornamental insulation is shown in Fig. 158.

Acoustic insulation makes a very practical ceiling surface, for example, and at the same time it reduces sound to a minimum. This



Fig. 158. Ornamental Insulation
Courtesy of Celotex Company, Chicago, Ill.

material can be painted, or it comes in various colors. Fig. 159 shows an example of insulation of this type.

SIZES AND THICKNESSES OF VARIOUS MATERIALS. The various types of insulation also differ widely in sizes and thicknesses, making it possible to use them under many conditions.

Sizes. Fill insulation has no size, as it is loose. It may, however, be bought in sacks of various sizes.

Blanket and batt types are made to fit between studs, rafters, and joists whose standard spacing is 16" O.C.

Metallic types, also, ordinarily are made in rolls of such width that the material can be placed between studs, rafters, or joists.

Rigid types are made in various sized sheets, based, however, on the standard 16" O.C. spacings of rafters, studs, and joists.

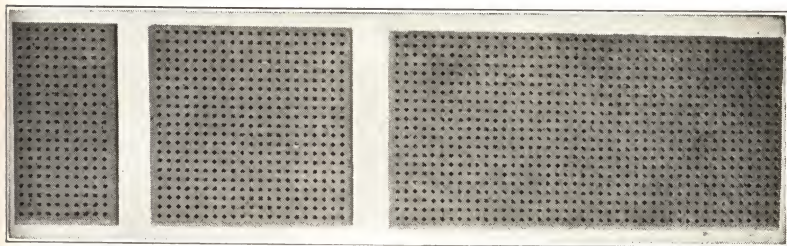


Fig. 159. Acoustic Insulation
Courtesy of Celotex Company, Chicago, Ill.

Decorative and acoustic types vary from small tile sizes (see *K* in Fig. 168) to large sheets, as used at *L* in Fig. 160, and sizes, as shown in Figs. 176 and 178.

Thickness. Blankets and batts vary from one to four inches in thickness.

Rigid types vary in thickness from one-quarter inch to the one inch size ordinarily used in walls, floors, and pitched roofs.

Metallic types vary from paper thickness to about one-half inch.

Decorative and acoustic types vary from a quarter-inch to one inch.

WHERE INSULATION IS USED IN REMODELING. In complete remodeling, any kind of insulation can be used, because the spaces where insulation is to be installed are readily accessible. However, in partial remodeling or modernizing, the siding, sheathing, and plaster

are not materially altered or disturbed, and for that reason the customary spaces for the installation of some kinds of insulation are not accessible. In the following pages, then, the use of the various types of insulation is explained, first for complete, and then for partial remodeling, or modernizing.

Complete Remodeling. In complete remodeling, the application of insulation must be planned in advance of actual structural work,

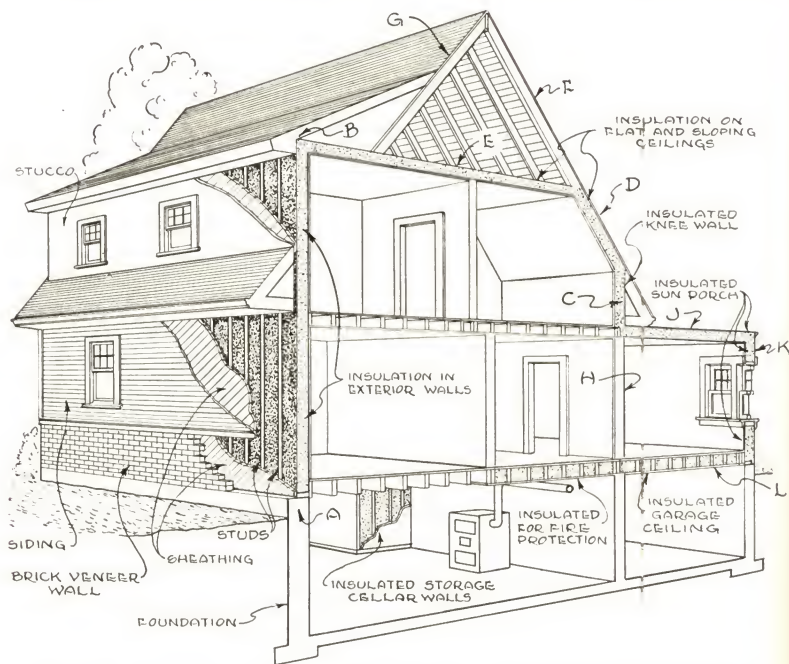


Fig. 160. Where Fill-Type Insulation Can Be Used. The Insulation is Shown by Dots

so that the carpenters or men who install the insulation can place their materials in proper relation to the rest of the work. For example, any insulation used in a wall must be put into place before either sheathing or lathing is applied.

Fill Type. This type of insulation can be used wherever there are structural parts to keep it in place. In walls, the sheathing and lathing keep the material in place, and in ceilings the lathing serves to hold it in place. When it is used in roofs, the bottom or inside edge of the rafters must be covered with some sort of sheathing before this

type of insulation can be used. If the material is used in a first floor, bottoms of the joists must likewise have sheathing nailed to them.

Wherever fill insulation is used, it should be packed in place very carefully, to avoid the possibility of spots being missed, which would ruin the effect in many ways. Careful handling of this type of insulation is of great importance. Every bit of the space which it is to fill should be packed evenly, and in accordance with the specifications of the manufacturer.

Fig. 160 shows a perspective section of a house in which three types of exterior walls are illustrated. The purpose of this illustration is to show where fill type of insulation can be used within brick veneer, frame, and stucco walls.

If the walls are a full two stories high, as the walls at *AB*, the fill should start at the plate on top of the foundation, *A*, and completely fill the space between the studs all the way up to the top plate at *B*.

Where the roof forms part of the second-floor walls, as at *D*, and where a knee wall, *C*, forms another part of the wall, the insulation should be put at *C*, *D*, and *E*. Never attempt to put fill at *F* or *G*, but always at *E*.

Where a sun porch adjoins one wall, *H*, of a house, it is best to omit fill at *H*, and put it in the sun porch roof, *J*, and wall, *K*. There is no need, in this instance, for placing fill at *H*.

If the garage is in the basement of the house, as it is in Fig. 160, its ceiling should be insulated for fire protection, even if the garage is heated. Most insulations form excellent fire protection, because if they burn at all it is very slowly, and only when subjected to intense heat. Other portions of a first floor are often insulated, not only for fire protection, but to prevent heat loss where basement temperature is lower than 70°.

With the exterior wall, *AB*, and other areas shown in Fig. 160 all insulated, no insulation would be placed in the second floor. Since the rooms above and below are heated, insulation at this point would serve no purpose.

In houses with solid brick, or other masonry, walls, the use of fill insulation is limited to ceilings, floors, roofs, and knee walls.

Blanket Type. Many types of blanket insulation have flanges or other means of nailing the material between studs and rafters. Fig. 161 shows these flanges and how they may be folded. Fig. 162 illus-

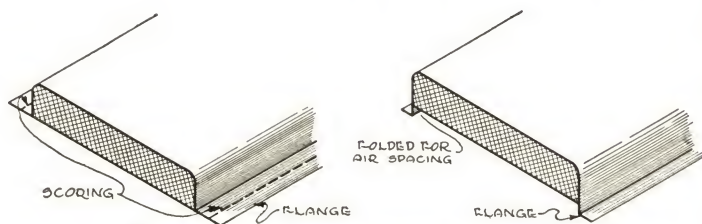


Fig. 161. Typical Blanket Insulation Showing Flanges

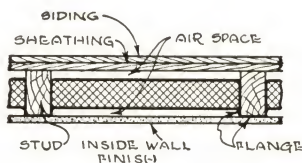


Fig. 162. Blanket Insulation In Frame Wall with Flanges Folded to Provide Air Spaces

trates the manner in which the folding of the flanges provides two air spaces in a stud wall.

When blanket types are used in attic floors, as at *E* in Fig. 160, they are placed between joists as shown in Fig. 163. When they are put between studs, they are applied in the manner shown in Fig. 164.



Fig. 163. How Typical Blanket Insulation Is Placed Between Attic-Floor Joists
Courtesy of U.S. Gypsum Company, Chicago, Ill.

Blankets could be used successfully in areas *AB, C, D, E, J,* and *K*, in Fig. 160.

In the application of blanket-type insulation, care should be taken to see that the flanges or edges are nailed in place carefully, and at the intervals specified by the manufacturer.

Notice that these blankets are made so that they will just fit between studs, joists, and rafters spaced 16 inches on center.



Fig. 164. How Typical Blanket Insulation Is Placed Between Studs

Courtesy of U.S. Gypsum Company, Chicago, Ill.

Batt Type. Batt insulation could be used at *AB, C, D, E, J,* and *K* in Fig. 160. Batts are also made so that they will exactly fit between joists, studs, and rafters when these members are spaced 16" O.C. Figs. 165 and 166 show detailed views of how batts are placed between studs and rafters. The application of batts between ceiling joists, is the same, except that the batts are allowed to rest on the plaster below them.

When pipes or electrical conduits are encountered, the batts should be carefully filled in around the pipe or conduit, so that the insulation will hug them tightly. Batts should be fitted carefully to-

gether, also. When batts are nailed into place, care should be taken to follow the nail spacing indicated in the manufacturers' specifications.

Metallic Type. There are various forms of this type of insulation. Some of them are simply thin sheets, and some are reinforced, like that shown in Fig. 154. Fig. 167 shows a typical application of the reinforced kind. This insulation is so applied between the studs as to leave an air space on either side of it. The same is true where it is installed between rafters or joists. A nailing strip is used, and small nails are driven to hold the material firmly against the studs, rafters,

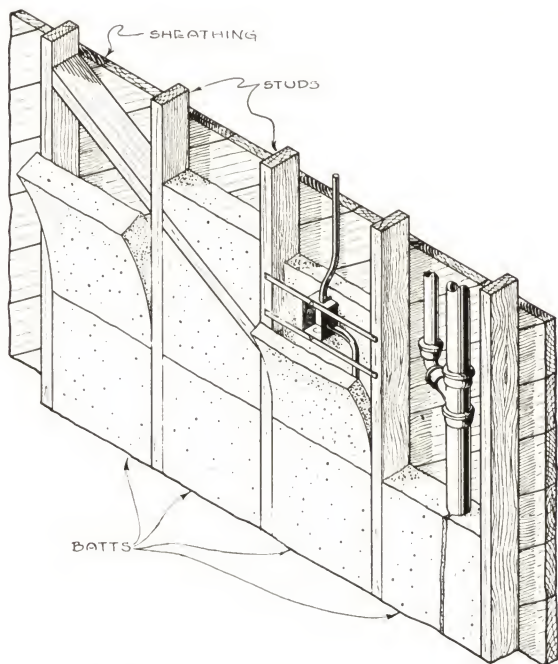


Fig. 165. Typical Batt Insulation in Frame Wall

or joists. If two layers are required, they are applied in like manner, leaving an air space between the two layers. The kind of metallic insulation illustrated in Figs. 154 and 167 could be used at *AB*, *C*, *D*, *E*, *J*, and *K* in Fig. 160.

Rigid Type. Rigid insulation can be used in place of conventional finishing materials, such as lath, sheathing, and rough flooring.

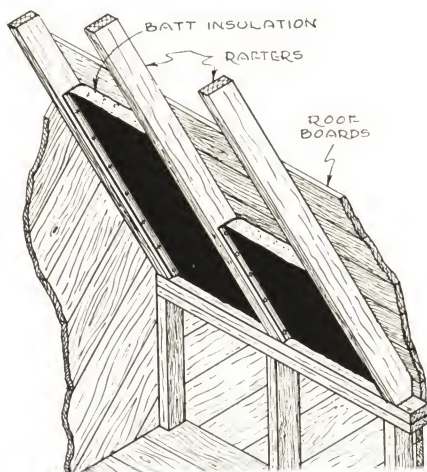


Fig. 166. Typical Batt Insulation in Roof

Fig. 168 shows a perspective section of a house, and the areas in which rigid insulation can be used.

At *A*, rigid insulation is used in place of wood sheathing as well as for insulation. It is nailed directly to the studs, then brick veneer or siding is placed over it. Care must be taken that the nails holding both the insulation and the siding be placed so they fasten to studs, because this insulation material will not hold nails.

At *B*, rigid insulation is used as plaster backing, in place of wood or metal lath. For this purpose, the insulation can be pur-

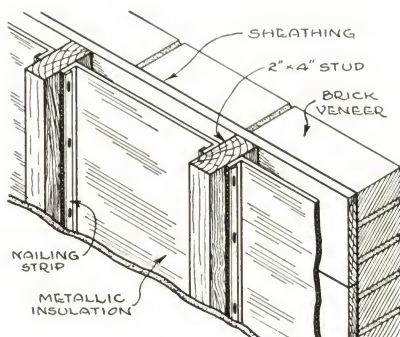


Fig. 167. Application of Typical Metallic Insulation

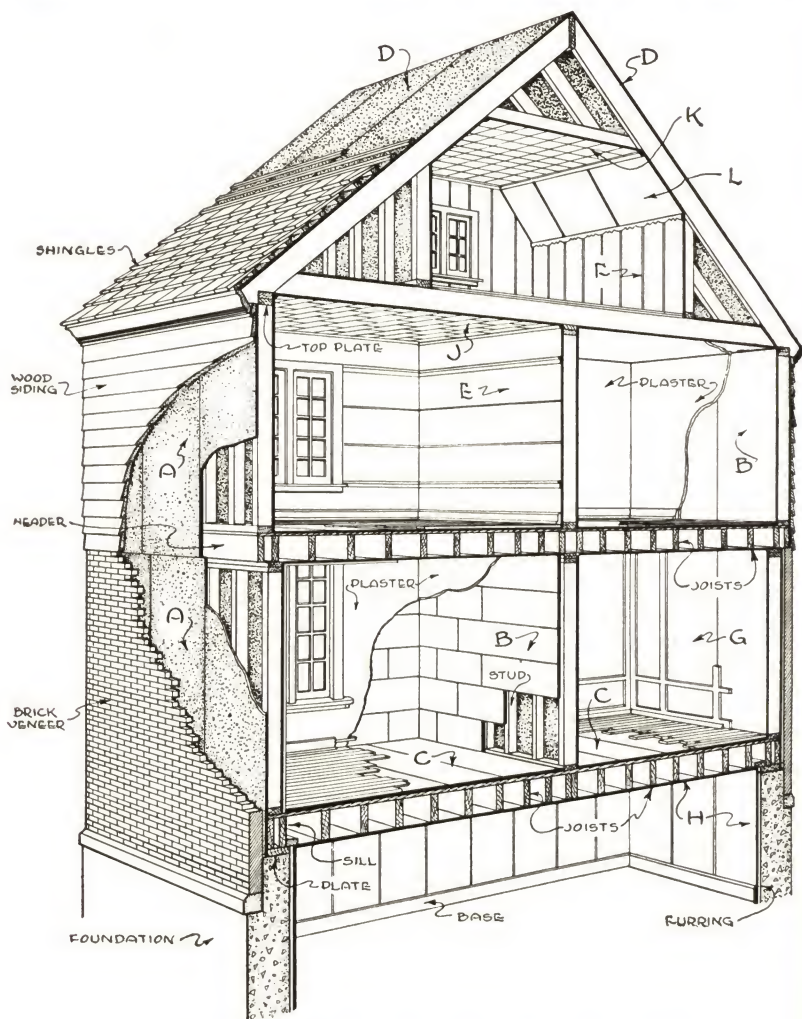


Fig. 168. Section of Building Showing Typical Uses of Rigid Insulation

chased either in small panels or in large sheets. Examples of both are shown in Fig. 168.

At C, rigid insulation is used in place of rough flooring. It should be placed with its edges parallel to the joists.

At D, rigid insulation takes the place of roof boards.

Sometimes rigid insulation is put between rough and finish flooring, as added protection against heat loss and dust.

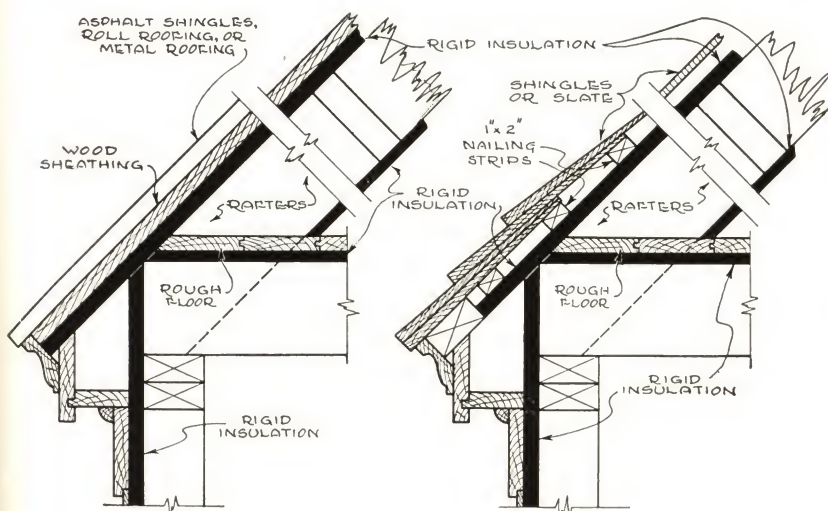


Fig. 169. Section of a Cornice Showing How Rigid Insulation Can Be Used on Top of Rafters with Wood Sheathing or Nailing Strips over the Insulation

Figs. 169 and 170 show detailed views of cornice construction, where rigid-type insulation may be used in connection with various kinds of roofing material.

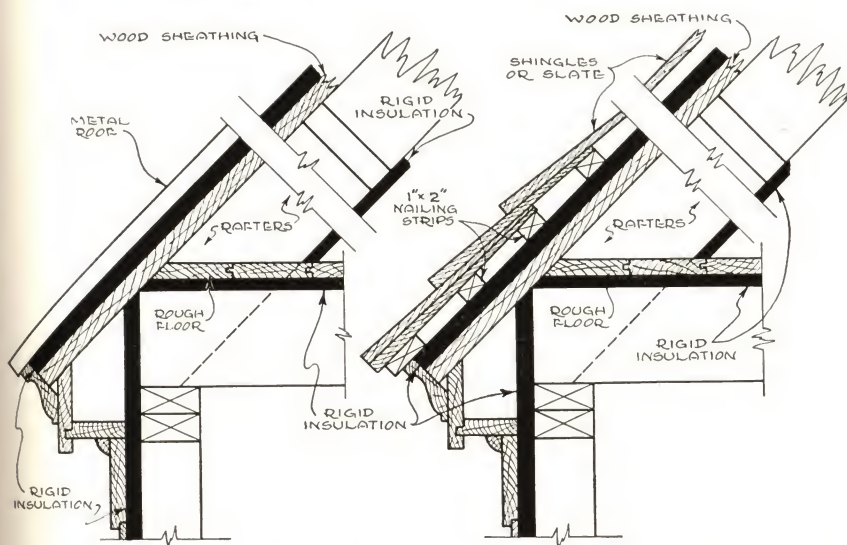


Fig. 170. Same as Fig. 169 Except That Rigid Insulation Is Used over Wood Sheathing

Rigid insulation can also be placed in strips between studs, rafters or joists, as shown in Fig. 171.

Ornamental and Acoustic Type. At E, F, G, H, J, K, and L, in Fig. 168, are areas where ornamental types of insulation can be used. The type used at H, however, usually is a plain board or sheet type. Acoustic insulation can be used on any ceiling, both as thermal and sound insulation.

Modernizing. Where little structural change or addition is involved, as in modernizing or partial remodeling, the selection of insula-

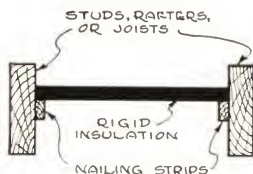


Fig. 171. How Rigid Insulation Can Be Used Between Joists, Studs, or Rafters

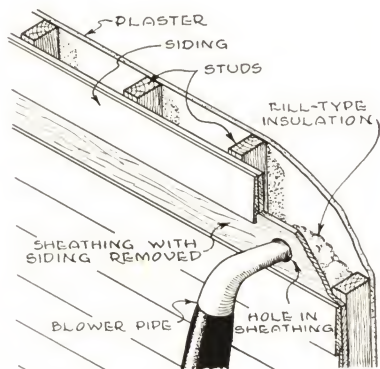


Fig. 172. How Fill-Type Insulation Is Blown into Exterior Walls

tion is much more limited, being confined to those kinds which can be applied without disturbing plaster, flooring, and like structural details.

The following paragraphs explain the uses that various kinds of insulation might have in partial remodeling or modernizing typical old houses.

Fill Type. If the exterior walls are not to be altered, either on the outside or inside surfaces, a fill type of insulation can be blown into the walls under pressure. This is applied by removing one or two pieces of siding, a few bricks, or a few shingles, as the case may be, and drilling holes through the sheathing. One hole, of course, must be drilled between each pair of studs. A hose is then inserted into the hole, as illustrated in Fig. 172, and the insulation is blown in. When the required areas have been filled, the siding, bricks, or shingles are replaced.



Fig. 173. How Fill-Type Insulation Is Applied Between Attic Joists
Courtesy of Johns-Manville Corp., New York, N.Y.

Where attic floors are to be insulated, the fill may be placed by a hose as shown in Fig. 173. This is possible only where no attic floor is in place.

Fill insulation can be used in pitched roofs if there is some form of sheathing on the underside of the rafters.

Fig. 174 shows how the living quarters of an old house may be insulated with fill-type material. At A, where the attic is not heated,

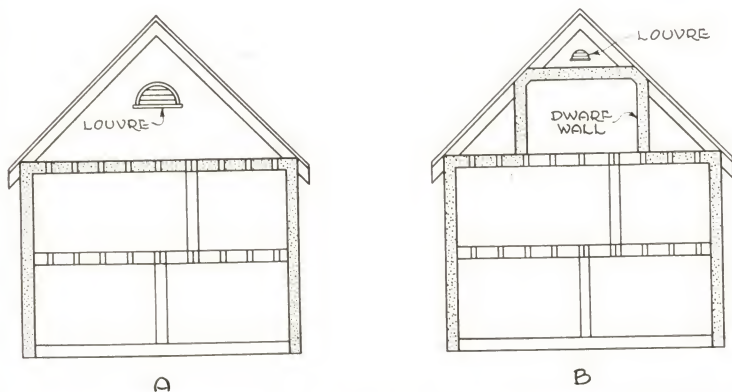


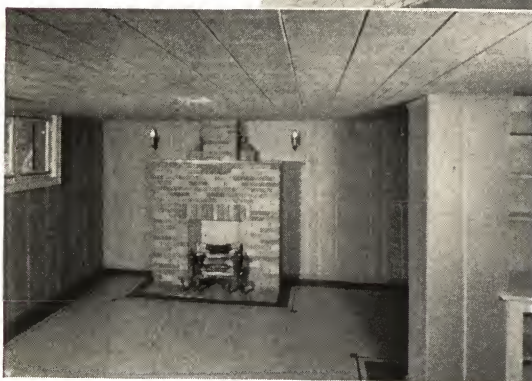
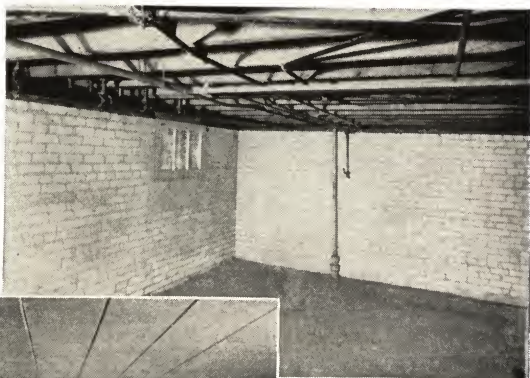
Fig. 174. Where Fill Insulation Can Be Put in the Walls and Ceilings of an Old House without Requiring Alterations

the walls and second-floor ceiling are filled with the material. At B, where an attic room is present, the main walls, the attic ceiling, part of the second-floor ceiling, and the knee walls are filled with the material.

Blanket and Batt Types. It is impossible to apply blanket or batt types of insulation if the walls or floors are not to be disturbed in the modernizing work.

Right, Fig. 175. Typical Old Basement

Courtesy of Wood Conversion Company, St. Paul, Minn.



Left, Fig. 176. Basement of Fig. 175 After Remodeling. Note Insulation on Walls and Ceiling

Courtesy of Wood Conversion Company, St. Paul, Minn.

In unfinished attics, however, either of these materials may be used very successfully between rafters and joists, as in Figs. 163, 164, and 166.

Metallic Types. This material, likewise, is limited to accessible areas such as roofs and attic floors, or any other portion of the structure where the studs, rafters, or joists are not closed in by sheathing, plaster, or flooring.

Rigid Type. This insulation material is also limited to use in those structural parts which are not closed in.

Decorative Type. Where an attic or basement area is being mod-

ernized to form sleeping rooms or a recreation room, the decorative type of insulation can be used to advantage.

In Fig. 175 we see one corner of a basement before it was modernized. Fig. 176 shows the same corner after a very pleasant recreation room had been constructed, using the decorative-type insulation.

Fig. 177, also, shows a part of a basement which had been used as a garage and general storage place, whereas Fig. 178 shows the same basement area, after decorative insulation had been used to transform this unsightly corner into an attractive recreation room. (Note that the basement in Fig. 177 is at ground level. This occurs because the house is built on a sloping lot.)



Fig. 177. Typical Old Basement Garage



Fig. 178. Basement of Fig. 177 After Re-modeling. Note Insulation on Walls and Ceiling

Courtesy of Wood Conversion Company, St. Paul, Minn.

HOW TO CALCULATE HEAT LOSSES. During the winter months, when the inside temperature of houses is considerably higher than the outside temperature, there is a decided heat loss from the inside to the outside, because heat tends to travel from a high to a lower temperature level. If the walls, roofs, and floors of houses are not insulated properly, the heat loss is great.

In order to calculate the amount of this heat loss, we must understand a few simple symbols and rules used by heating engineers.

B.t.u. Heat losses are measured in terms of B.t.u. This symbol means *British Thermal Unit* and represents the amount of heat re-

quired to raise one pound of water 1°F. This unit is used to measure heat energy just as the gallon is used to measure liquids.

U. In calculating heat losses from houses, we must first determine the rate at which such loss takes place *per hour*. The symbol *U*, then, is used to indicate the over-all transmission coefficient, which in turn indicates the rate of heat loss per hour.

This symbol *U*, however, indicates only the rate of loss for one square foot of a wall or roof, and for only 1°F. difference in temperature between inside and outside air. Therefore it must be multiplied by the number of square feet in a wall, for example, and also by the real difference, between inside and outside temperatures. This is explained more fully a little later.

$(t - t_o)$. In this symbol the *t* represents interior temperature and the *t_o* represents outdoor temperature. To find the temperature difference between the inside and outside of a house subtract *t_o* from *t*. Thus if the interior temperature, in a given case, is 70° and the outside temperature is 0°, the temperature difference would be $70^\circ - 0^\circ = 70^\circ$.

Example 1. Suppose that an interior wall of a house has a *net* area (minus window and door areas in this example) of 250 square feet, that the inside temperature is 70°, that the outside temperature is 0°, and that *U* equals .50. Find heat loss per hour.

Solution Rule. To calculate the heat loss per hour multiply the area by the *U* value by the temperature difference. This operation can be shown by a simple formula.

$$H = AU(t - t_o)$$

Where

H = heat loss per hour

A = area

U = transmission coefficient (rate of loss)

t = inside temperature

t_o = outside temperature

All of these symbols and their meanings have already been explained.

To solve the example, substitute the actual values in place of the symbols and multiply.

$$H = AU(t - t_o)$$

Table 7. *k* Values for Typical Materials

The *k* values are per inch of thickness except where * is shown, in which cases the value is for thickness used in construction.

Material	<i>k</i>	Material	<i>k</i>
Wood siding*	1.28	Stone	12.50
Wood sheathing	.80	Stucco	12.00
Lath and plaster	2.50	Fill insulation	.27
Plaster	3.30	Cork board	.30
Rigid insulation	.327	Asbestos	2.70
Common brick	5.00	Wood shingles	1.28
Face brick	9.20	Asbestos shingles	6.00
Concrete	12.00	Asphalt shingles	6.50
Pine	.80	Math lath and plaster	4.40
Oak	1.15	Plaster board ½"	3.73
Maple	1.15	Concrete blocks 8"	1.00
Cinder concrete	5.20	Tile 4"	1.00

Courtesy of American Society of Heating & Ventilating Engineers, From A.S.H.V.E. Guide, 1940.

Substituting,

$$H = 250 \times .50 (70^\circ - 0^\circ)$$

$$H = 250 \times .50 \times 70^\circ$$

$$H = 8,750 \text{ B.t.u. per hour}$$

Notice that the above calculations follow the rule we have stated.

How to Find *U* Values. The *U* symbol represents the rate of heat loss for the complete *thickness* of structural parts, a wall for example. This thickness includes siding, brick, sheathing, lath and plaster, or insulation—according to the construction of the wall.

In order to determine the *U* value for a wall, or any other part of a house, we must consider the rate of heat loss through all the structural members composing the wall. The rate of heat loss for each member of a wall is represented by the symbol *k*. The *k* values for typical building materials are shown in Table 7.

The *k* values for other materials may be obtained from manufacturers or from the same source as Table 7.

The air spaces in walls and in other structural parts also have a *k* value. For all general purposes this value may be assumed to be 1.10.

The outside surface of a wall or other structural part is represented by the symbol *f_o* and the inside surface by *f_i*. The values to use in all general cases are shown in Table 8.

Knowing the *k* values for all parts of a wall, or other parts of

Table 8. k Values of Surfaces

Outside surface (air in motion) (f_o)	6.00
Inside surface (still air) (f_i)	1.65

houses, the next step is to find the *resistance* which is represented by R . To find the resistance for any material, air space, or surface simply divide 1 by the k value. Thus if the k value in a given case is .80 the R value is $1 \div .80 = 1.25$. U may be determined by dividing 1 by the sum of the R values.

Example 2. Note the section of a typical frame wall in Fig. 179. The wall is composed of siding, 1" wood sheathing, 2x4 studs, and wood lath and plaster. Find the value of U .

Solution. The k values shown in Fig. 179 were taken from Tables

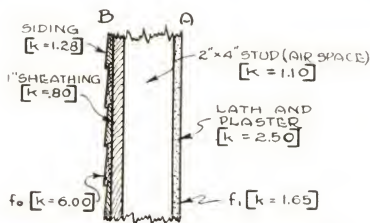


Fig. 179. Typical Frame Wall in Section

7 and 8, except for air space which was given as 1.10. In Fig. 179 the A indicates the inside surface of the wall and the B the outside surface.

The first step is to find the various R values.

Outside surface (f_o)	$k = 6.00$ and $R = 1 \div 6.00 = .17$
Siding	$k = 1.28$ and $R = 1 \div 1.28 = .78$
Sheathing	$k = .80$ and $R = 1 \div .80 = 1.25$

Between the 2x4 studs there is an air space.

Air space	$k = 1.10$ and $R = 1 \div 1.10 = .91$
Lath and plaster	$k = 2.50$ and $R = 1 \div 2.50 = .40$
Inside surface (f_i)	$k = 1.65$ and $R = 1 \div 1.65 = .61$

The next step is to add the various R values.

$$R = .17 + .78 + 1.25 + .91 + .40 + .61 = 4.12$$

Then to find the U value, divide 1 by the sum of the R values.

$$U = 1 \div 4.12 = .24 \text{ (approximately)}$$

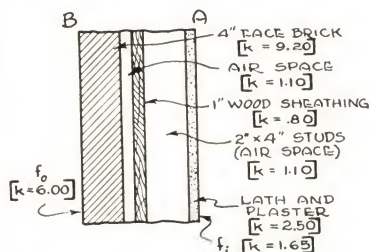


Fig. 180. Typical Brick Veneer Wall in Section

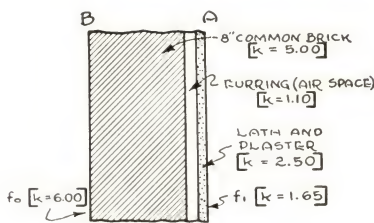


Fig. 181. Typical Solid Brick Wall in Section

Example 3. Note the section of a typical brick veneer wall in Fig. 180. The wall is composed of 4" of face brick, air space, 1" wood sheathing, 2x4 studs, and wood lath and plaster. Find the value of U .

Solution. The k values shown in Fig. 180 were taken from Tables 7 and 8, excepting the air space. First find the R values.

Outside surface (f_o)..... $k=6.00$ and $R=1 \div 6.00 = .17$

4" face brick..... $k=9.20$ and $R=1 \div 9.20 = .11$

The R value of .11 is for only 1" because the k values in Table 7 are for only 1". The bricks are 4" thick so $4 \times .11 = .44$ which is the R value to use.

Air space..... $k=1.10$ and $R=1 \div 1.10 = .91$

1" wood sheathing..... $k=.80$ and $R=1 \div .80 = 1.25$

2x4 air space..... $k=1.10$ and $R=1 \div 1.10 = .91$

Wood lath and plaster..... $k=2.50$ and $R=1 \div 2.50 = .40$

Inside surface (f_i)..... $k=1.65$ and $R=1 \div 1.65 = .61$

Adding R values

$$R = .17 + .44 + .91 + 1.25 + .91 + .40 + .61 = 4.69$$

$$U = 1 \div 4.69 = .21 \text{ (approximately)}$$

Example 4. Note the section of a typical solid brick wall in Fig. 181. The wall is composed of 8" of common brick, 1" furring, and wood lath and plaster. Find the value of U .

Solution. The k values shown in Fig. 181 were taken from Tables 7 and 8, excepting the air space. First find the R values.

Outside surface (f_o)..... $k=6.00$ and $R=1 \div 6.00 = .17$

Common brick..... $k=5.00$ and $R=1 \div 5.00 = .20$

The actual thickness of the brick wall is 8" so the R value becomes $8 \times .20 = 1.60$.

Furring air space..... $k=1.10$ and $R=1 \div 1.10 = .91$
 Lath and plaster..... $k=2.50$ and $R=1 \div 2.50 = .40$
 Inside surface (f_i)..... $k=1.65$ and $R=1 \div 1.65 = .61$

Adding R values:

$$R=17+1.60+.91+.40+.61=3.69$$

$$U=1 \div 3.69 = .27 \text{ (approximately)}$$

Example 5. Note the section of a typical frame roof in Fig. 182. The roof is composed of wood shingles, 1" roof boards, 2x6 rafters, and wood lath and plaster. Find the value of U .

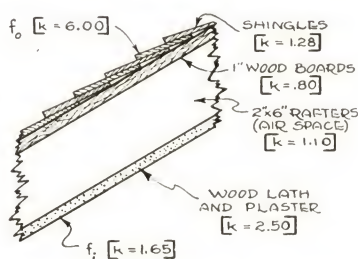


Fig. 182. Typical Frame Roof in Section

Solution. The k values shown in Fig. 182 were taken from Tables 7 and 8, excepting the air space. First find the R values.

Outside surface (f_o)..... $k=6.00$ and $R=1 \div 6.00 = .17$

Shingles..... $k=1.28$ and $R=1 \div 1.28 = .78$

1" wood roof boards..... $k = .80$ and $R=1 \div .80 = 1.25$

2x6 air space..... $k=1.10$ and $R=1 \div 1.10 = .91$

Wood lath and plaster..... $k=2.50$ and $R=1 \div 2.50 = .40$

Inside surface (f_i)..... $k=1.65$ and $R=1 \div 1.65 = .61$

Adding R values

$$R = .17 + .78 + 1.25 + .91 + .40 + .61 = 4.12$$

$$U = 1 \div 4.12 = .24 \text{ (approximately)}$$

U Values for Windows and Doors. Table 9 shows the common U values for typical doors and windows. Here the U values are given directly, and it is not necessary to calculate them. Note that doors having thin wood panels have the same U value as single glass.

HOW TO CALCULATE HEAT LOSSES FOR HOUSES. Up to this point we have seen how to use the heat-loss formula and how to

Table 9. Coefficients of Transmission (U) of Windows and Doors

Windows	
Description	U
Single glass	1.13
Double glass	.45
Triple glass	.281

Doors*					
Nominal Thickness Inches	Actual Thickness Inches	U	Nominal Thickness Inches	Actual Thickness Inches	U
1	$\frac{2}{32}$	.69	2	$1\frac{5}{8}$	.46
$1\frac{1}{4}$	$1\frac{1}{16}$	.59	$2\frac{1}{2}$	$2\frac{1}{8}$	.38
$1\frac{1}{2}$	$1\frac{5}{16}$	.52	3	$2\frac{5}{8}$	.33
$1\frac{3}{4}$	$1\frac{3}{8}$.51

*Doors having thin wood panels can be assumed to have a U value of 1.13.

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calculate most of the symbols used in that formula. Now the application of this process to the calculation of heat losses for a complete house can be illustrated by a few explanations and examples.

Generally attics (spaces between roof and ceiling) are not heated. If there are attic windows the air in the attic space becomes just about as cold as the outside air during the winter. Thus for general heat-loss calculations it is safe to assume attic temperatures the same as for exterior air.

If basements are not used as living quarters they are not heated. However, the heating equipment warms this area somewhat. For general purposes it is accurate enough to assume basements at 50°F.

For ordinary or average weatherstripped windows there is a loss of heat due to the flow of heat through the glass by transmission, and also due to the cracks around the windows. For average conditions a U value of .51 can be used for cracks. How this is used is explained later.

In doors also there is a heat loss by transmission, and there is a loss due to cracks. For average conditions a U value of .51 can be used for door cracks.

Example 6. Note Fig. 183. This figure shows the floor plan for a one-story house. Calculate the total heat loss per hour for this house using the following specifications and assuming that the attic and basement are not heated for occupancy.

Side Walls. 2x4 studs with $\frac{7}{8}$ -inch wood sheathing and shingle siding. The inside is wood lath and plaster.

Roof. 2x6 rafters, $\frac{7}{8}$ -inch pine roof deck, asbestos shingles.

First Floor. 2x10 joists, $\frac{5}{8}$ -inch rough pine floor and $\frac{3}{4}$ -inch finish oak floor. Underside of joists left open.

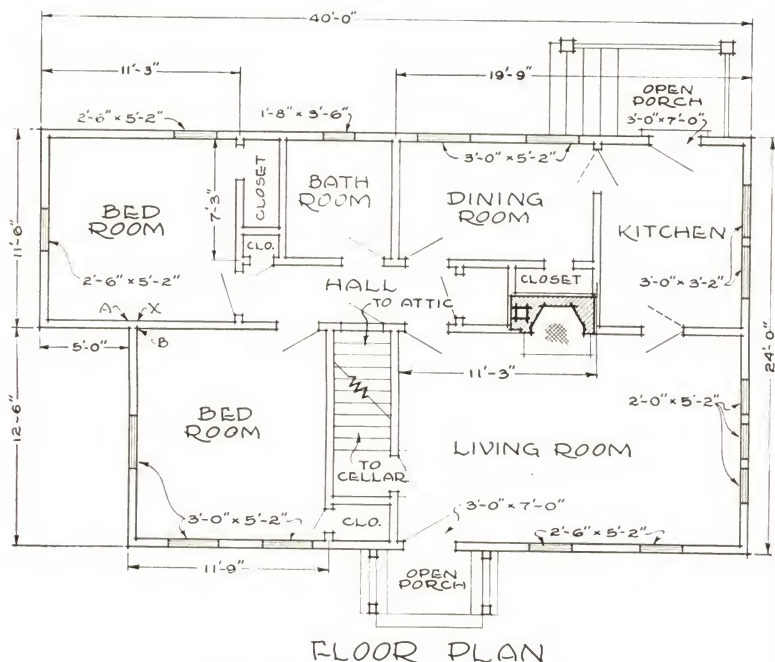


Fig. 183. Floor Plan for a One-Story House

Attic Floor—First-floor ceiling. 2x10 joists. $\frac{7}{8}$ -inch pine floor boards in attic and wood lath and plaster for ceiling.

General. Assume the lowest outside temperature to be $0^{\circ}\text{F}.$; inside to be maintained at $70^{\circ}\text{F}.$ The doors have thin panels. The basement temperature is considered as $50^{\circ}\text{F}.$ There are two attic windows. Assume the ceiling height to be 9'0" above the floor.

Solution. The attic windows will tend to keep the attic air temperature about the same as outdoor air because of the leakage through and around them. Therefore use outside temperature for the attic.

First it is necessary to consider through what structural parts heat loss will take place.

According to the statement of the example only the various rooms and halls are to be heated. Therefore, the heated area is bounded by the ceiling, outside walls, and floor. Heat losses for the roof need not be calculated, since the ceiling which contacts the cold air is calculated, instead of the roof. Thus heat losses must be calculated through these areas plus the windows and doors in these areas.

To facilitate the solution of this problem, Table A is used to show all the areas, U values, etc. Also only R values are shown in calculating U values because we have already learned to determine R values from k values.

The first step is the calculation of the various U values.

The ceiling is composed of 2x10 joists, $\frac{7}{8}$ " flooring and lath and plaster. The flooring and ceiling are both on the inside of the house so we must use "inside surface conductance" (f_i) for both the floor and plaster surfaces.

Inside surface (f_i)	$R = .61$
* $\frac{7}{8}$ " pine flooring	$R = 1.09$
Air space	$R = .91$
Lath and plaster	$R = .40$
Inside surface (f_i)	$R = .61$
Total	$R = 3.62$

$$U = \frac{1}{3.62} = .28$$

Put the U value in Table A.

*The R value for pine is 1.25. But our floor is only $\frac{7}{8}$ " = .875" thick. So, $1.25 \times .875 = 1.09$.

The floor is composed of 2x10 joists, $\frac{5}{8}$ " rough pine flooring and $\frac{3}{4}$ " oak finish flooring. Both sides of the floor are within the building so we must use (f_i) values on both sides.

Inside surface	$R = .61$
* $\frac{3}{4}$ " oak floor	$R = .65$
† $\frac{5}{8}$ " rough (pine) floor	$R = .78$
Inside surface	$R = .61$
Total	$R = 2.65$

$$U = \frac{1}{R} = \frac{1}{2.65} = .38$$

Put this U value in Table A.

*The k value for oak is 1.15 or the R value is .87. The oak is $\frac{3}{4}$ " = .75" thick. Then $.87 \times .75 = .65$.

†The R value for pine is 1.25. The flooring is $\frac{5}{8}$ " = .625" thick. Then $1.25 \times .625 = .78$.

The side walls are made of 2x4 studs, $\frac{7}{8}$ " wood sheathing, shingle siding, and wood lath and plaster.

The U value is figured in the same manner as explained for Fig. 179, substituting the proper materials. The U value is .25. Put this in Table A.

The U value for windows is 1.13. The same U value can be used for doors, as explained under Table 6. Put these in Table A. The U value for the cracks around windows and doors can be taken as .51. Put this in Table A.

The next step is to calculate the various areas.

The ceiling covers the entire house. This house is irregular in shape so we can calculate the area in two parts. Since the inside wall areas contact the warm air, only the interior dimensions are used in calculating area. The ell is 5'0" longer than the main part of the house. The 40'0" length includes the ell. Leaving out the ell the length of the house would be 35'0". Frame walls are 6" (approx.) thick. Deducting two wall thicknesses we have $35'0" - 1'0" = 34'0"$, the length of the dimension we are considering. The width of the house is 24'0". This, minus two wall thicknesses becomes $24'0" - 1'0" = 23'0"$. Thus the interior dimensions for the main portion of the house are $34'0" \times 23'0"$. The interior dimensions for the ell are 5'0" (the inside dimension extends to point X) $\times 10'6"$.

Then $34'0" \times 23'0" = 782$ sq. ft.

And $5'0" \times 10'6" = 53$ sq. ft.

Ceiling Area = 835 sq. ft.

This is put in Table A.

The floor area is naturally the same as the ceiling.

The window sizes are shown in Fig. 183. There are 4 windows $2'6" \times 5'2"$. The area of one such window is $2\frac{1}{2} \times 5\frac{1}{6} = 12\frac{11}{12}$ sq. ft. Call it 13. Then 4 windows would be $4 \times 13 = 52$ sq. ft. There are 2 windows $3'0" \times 3'2"$. The area of one such window is $3 \times 3\frac{1}{6} = 9\frac{1}{2}$ sq. ft. Then 2 windows would be $2 \times 9\frac{1}{2} = 19$ sq. ft. There are 5 windows each of which is $3'0" \times 5'2"$. The area of one such window is $3 \times 5\frac{1}{6} = 15\frac{1}{2}$ sq. ft. Then $5 \times 15\frac{1}{2} =$ approximately 78 sq. ft.

There are 3 windows, each of which is $2'0" \times 5'2"$. One such window has an area of $2 \times 5\frac{1}{6} =$ about 11 sq. ft. Then $3 \times 11 = 33$ sq. ft.

There is one window $1'8'' \times 3'6'' = 1\frac{2}{3} \times 3\frac{1}{2} =$ approximately 6 sq. ft.

The total window area is then $52 + 19 + 78 + 33 + 6 = 188$ sq. ft. Put this in Table A.

There are 2 doors each $3'0'' \times 7'0''$. Each door is $3 \times 7 = 21$, and $2 \times 21 = 42$ sq. ft. Put this in Table A.

To calculate wall areas it is easier to figure the total perimeter or length of wall around a house first. Use interior dimensions. Start at corner by the back porch.

The long $40'0''$ dimension has two wall thicknesses deducted in order to obtain interior dimensions and becomes $39'0''$.

The $11'6''$ dimension has two wall thicknesses deducted and becomes $10'6''$.

The $5'0''$ dimension has one wall deducted and becomes $4'6''$. However, if the inside dimensions of the house are considered as a continuous line, the dimensions must meet at point X. The $4'6''$ dimension stops at A, so six inches must be added to extend it to X. Therefore the $4'6''$ dimension becomes $5'0''$.

The $12'6''$ dimension has one wall deducted and becomes $12'0''$ where it ends at point B. This dimension also must be extended to point X, and so it becomes $12'6''$.

The dimension along the front of the house is already determined as $34'0''$.

The $24'0''$ dimension has two wall thicknesses deducted and becomes $23'0''$.

The total length of wall is then $39'0'' + 10'6'' + 5'0'' + 12'6'' + 34'0'' + 23'0''$ or $124'$.

To find gross wall area multiply total length by ceiling height. Thus the gross wall area is $124 \times 9 = 1116$ sq. ft. The *net* wall area is 1116 sq. ft. minus the window and door areas. The window plus door areas are $188 + 42 = 230$ sq. ft.

Net wall area is $1116 - 230 = 886$ sq. ft. Put this in Table A.

Next figure the lineal feet of cracks around windows and doors.

Four $2'6'' \times 5'2''$ windows. To figure window cracks for double-hung windows, add the two sides, top, bottom, and meeting rail. One $2'6'' \times 5'2''$ window has two sides $5'2''$ long, a top $2'6''$, a bottom $2'6''$, and a meeting rail $2'6''$. Total length = $17'10''$. Four such windows have a total crack of $4 \times 17'10'' = 71'4''$.

2—3'0"×3'2" windows. Total length = 30'8"

3—2'0"×5'2" windows. Total length = 49'

5—3'0"×5'2" windows. Total length = 96'8"

1—1'8"×3'6" window. Total length = 12'0"

*2—3'0"×7'0" doors. Total length = 40'0"

*For doors there are two sides, and top and bottom.

Total crack length is then 71'4" + 30'8" + 49' + 96'8" + 12'0" + 40'0" = 299'8" or 300 lineal feet. Put this in Table A.

The temperature difference for the walls, ceiling, windows and doors is 70° - 0° = 70°. However, for the floor the difference is 70° - 50° = 20°, because the basement temperature was given as 50°.

The final step is to use the heat-loss formula.

Ceiling. Formula, $H = AU (t - t_o)$

Substituting

$$H = 835 \times .28 \times 70$$

$H = 16,366$. This is put in Table A.

Floor. $H = 835 \times .38 \times 20 = 6,346$

Walls. $H = 886 \times .25 \times 70 = 15,505$

Windows. $H = 188 \times 1.13 \times 70 = 14,871$

Doors. $H = 42 \times 1.13 \times 70 = 3,322$

Cracks. $H = 300 \times .51 \times 70 = 10,710$

The total heat loss per hour is 67,120 B.t.u., as shown in Table A.

Table A

Surface	Area	t	Temperature Difference	B.t.u. Loss per Hour
Ceiling.....	835	28	70	16,366
Floor.....	835	38	20	6,346
Net walls.....	886	25	70	15,505
Windows.....	188	1.13	70	14,871
Doors.....	42	1.13	70	3,322
Cracks—length.....	300	.51	70	10,710
Total loss per hour.....				67,120

HOW TO DETERMINE SAVINGS IN HEAT LOSSES FOR REMODELING PLANS. When the plans for remodeling have been completed to the extent that the sizes of rooms and windows have been decided, it is time for consideration of the savings in heat losses that will result from insulation.

For example, assume that Fig. 183 represents a remodeling plan. The first step in consideration of insulation is to calculate heat losses

for Fig. 183, assuming that it is to be constructed of noninsulating materials, such as in Figs. 179, 180, 181, and 182. These calculations are exactly as illustrated in Example 6.

The next step is to assume that certain insulating materials have been added or substituted for noninsulating materials in the remodeling plan. By calculating the heat loss again, with these materials, the savings in heat loss through the use of insulation may be determined.

Example 7. In Fig. 183, substitute a $\frac{7}{8}$ -inch rigid insulation in place of wood sheathing, and half-inch rigid insulation in place of wood lath on exterior walls and ceiling. Also assume that one-half inch rigid insulation is nailed to the bottom edge of the floor joists.

(a) Calculate heat loss per hour.

(b) Calculate the savings in heat loss by comparing this answer (a) with the solution to Example 6, where insulation was not assumed. The difference represents the savings.

Solution (a). In this example the areas of the ceiling, walls, floor, windows, and doors remain the same as in Table A. The lineal feet of cracks and temperature differences also remain the same. These items are all shown again in Table B.

First calculate the U values. In the ceiling, $\frac{1}{2}$ -inch rigid insulation is used in place of wood laths. Calculate U as explained in foregoing example.

Inside surface (f_i)	$R = .61$
* $\frac{7}{8}$ " pine flooring	$R = 1.09$
Air space	$R = .91$
† $\frac{1}{2}$ " rigid insulation	$R = 1.53$
‡ $\frac{1}{2}$ " plaster	$R = .15$
§Inside surface (f_i)	$R = .61$
Total	$R = 4.90$

$$U = \frac{1}{R} = \frac{1}{4.90} = .204$$

Put this U value in Table B.

*For pine the R value is 1.25. Our floor is $\frac{7}{8}$ " = .875". So $1.25 \times .875 = 1.09$.

†Rigid insulation has a k value of .327. (See Table 7.) The R value = 3.05. The insulation is $\frac{1}{2}$ " (.50) thick. The R value is $3.05 \times .50 = 1.53$.

‡The R value for plaster is .30. For $\frac{1}{2}$ " (.50) the R value is $.30 \times .50 = .15$.

§The ceiling is within the structure so both surfaces have still air around them. Therefore use inside surface (f_i) for both sides. In cases such as this, the temperature difference does not enter in. An attic may be as cold as outside air, but it contains still air so the inside surface would have an R value of .61.

Table B

Surface	Area	U	Temperature Difference	B.t.u. Loss per Hour
Ceiling.....	835	.204	70	11,924
Floor.....	835	.196	20	3,273
Net walls.....	886	.15	70	9,303
Windows.....	188	1.13	70	14,871
Doors.....	42	1.13	70	3,322
Cracks—length.....	300	.51	70	10,710
Total loss per hour.....				53,403

In the floor, $\frac{1}{2}$ inch of rigid insulation is nailed to the bottom of the joists.

Inside surface (f_i).....	$R = .61$
* $\frac{3}{4}$ " oak floor.....	$R = .65$
† $\frac{5}{8}$ " rough (pine) floor.....	$R = .78$
‡Air space.....	$R = .91$
$\frac{1}{2}$ " rigid insulation.....	$R = 1.53$
§Inside surface (f_i).....	$R = .61$
Total.....	$R = 5.09$

$$U = \frac{1}{R} = \frac{1}{5.09} = .196$$

Put this U value in Table B.

*The R value for oak is .87. The oak is $\frac{3}{4}$ "=.75" thick. Then $.87 \times .75 = .65$.

†The R value for pine is 1.25. The floor is $\frac{5}{8}$ "=.625" thick. Then $1.25 \times .625 = .78$.

‡With the rigid insulation on the bottom of the joists an air space is formed between the joists.

§The floor is within the structure so both surfaces use (f_i).

In the walls $\frac{7}{8}$ -inch rigid insulation is substituted for wood sheathing, and $\frac{1}{2}$ -inch rigid insulation is substituted for lath.

Inside surface (f_i).....	$R = .61$
$\frac{1}{2}$ " plaster.....	$R = .15$
$\frac{1}{2}$ " rigid insulation.....	$R = 1.53$
Air space.....	$R = .91$
* $\frac{7}{8}$ " rigid insulation.....	$R = 2.67$
Shingles.....	$R = .78$
Outside surface (f_o).....	$R = .17$
Total.....	$R = 6.82$

$$U = \frac{1}{R} = \frac{1}{6.82} = .15$$

Put this in Table B.

* The k value of rigid insulation (Table 7) is .327. The R value is $1 \div .327 = 3.05$. The sheathing is $\frac{7}{8}$ "=.875" thick. Then $3.05 \times .875 = 2.67$.

Now the heat-loss formula can be applied using data in Table B and as explained in a foregoing example. The results are shown in Table B.

Solution (b). The difference between the total losses per hour for this and the foregoing example are:

$$\begin{array}{r} 67,120 \\ 53,403 \\ \hline 13,717 \end{array}$$

Thus the insulation saves 13,717 B.t.u. per hour.

Various combinations and kinds of insulations can be tried until the combination has been found that represents the greatest reduction in heat loss.

Summary. In Example 7, we assumed the use of rigid-type insulation for the house shown in Fig. 183, simply as a means of providing illustrative calculations. For any other type of insulation we would make our calculations using exactly the same principles. For example, suppose that in Fig. 183 a fill insulation is assumed for the exterior walls. The structure of the wall would then contain wood lath and plaster, $3\frac{5}{8}$ inches of fill insulation between the studs, 1 inch sheathing, and the shingles. There would be no air space, because the spaces between studs would be completely filled. For such a wall the U value is determined as follows:

Inside surface (f_i).....	$R = .61$
Wood lath and plaster.....	$R = .40$
* $3\frac{5}{8}$ inches fill insulation.....	$R = 13.41$
1" wood sheathing.....	$R = 1.25$
Shingles.....	$R = .78$
Outside surface (f_o).....	$R = .17$
Total.....	$R = 16.62$

$$U = \frac{1}{16.62} = .06 \text{ (approximately)}$$

*Table 4 shows that the k value for fill insulation is .27. Then the R value is $1 \div .27 = 3.70$ for one inch of the insulation. For $3\frac{5}{8}$ inches, the R value is $3.70 \times 3\frac{5}{8} = 3.70 \times 3.625 = 13.41$

In like manner we can determine the U value for any type or amount of insulation in a wall or other structural member.

HOW TO DETERMINE AMOUNT OF FUEL SAVED BY INSULATION. In Example 7 it was shown that by using a certain amount of insulation for the house in Fig. 183, an hourly savings of 13,717 B.t.u. can be realized. An average heating season totals 5,000 hours. Thus the seasonal saving amounts to $13,717 \times 5,000$, or 68,585,000 B.t.u.

Then if we calculate the amount of coal necessary to produce this 68,585,000 B.t.u., we will know the savings in coal per season.

Most coal has an average heat content of 13,000 B.t.u. per pound. However, because of unburned fuel, furnace inefficiency, and like factors, only about 60 per cent of 13,000, or 7,800 B.t.u. actually can be secured from one pound of coal.

Now, if we divide the 68,585,000 by 7,800, the result is approximately 8,800 pounds of coal. This is the amount of coal necessary to produce 68,585,000 B.t.u. There are 2,000 pounds of coal to a ton. Dividing 8,800 by 2,000 gives us approximately $4\frac{2}{5}$ tons of coal as one season's savings in fuel through insulation.

In the above illustration of fuel savings, we assumed the temperature difference (See Tables A and B) of 70°F. In parts of the country having milder climate, the actual temperature difference in winter might be considerably lower, on the average. Heat losses should be calculated on the basis of the average local temperature difference, determined by subtracting the average local outdoor temperature in winter from a fixed indoor temperature.

If additional insulation had been used in the house represented by Fig. 183, the savings in fuel would have been larger. However in this connection the principle of *diminishing returns* must come into consideration.

Principle of Diminishing Returns. This principle, as applied to insulation, is based on the fact that beyond a certain thickness or amount the effect of insulation is proportionately less and less beneficial. In other words, the effect or benefit of insulation per inch decreases as successive inches of thickness are added. Or, explained in still another way, the first inch is more effective than the second, the second inch is more effective than the third, and so on. Thus, if two inches of insulation are used in a wall or roof the first inch has more value than the second, although of course the two inches combined have more value than one inch alone.

In view of the above principle, careful consideration must be

given to determining the proper amount of insulation to use, in relation to its cost and to the resulting fuel savings. By applying the methods explained previously for calculating fuel savings, the truth of this principle may be proved. It will be found that with each added inch of thickness of insulation, the savings in B.t.u. per inch become less. In other words, and bearing out the principle of diminishing returns, 3 inches of insulation do not achieve three times the savings that one inch will achieve.

Ordinarily, the savings in fuel should pay for the cost of insulation in a few years at the most.

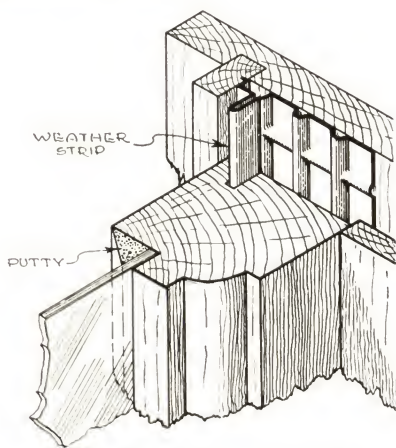


Fig. 184. Typical Weather Strip

MISCELLANEOUS WAYS OF RETARDING HEAT LOSSES. In addition to the use of insulating materials, there are a number of ways of retarding heat losses, and at the same time preventing drafts, condensation on windows, and other undesirable effects. These measures against heat loss should be carefully considered.

Weather Strips. Any old house which is to be remodeled is likely not to have any weather strips at all on the windows, or if there are any, they are probably badly worn. In either circumstance new weather strips should be planned, because a window without such protection allows cold drafts, as well as dust and dirt, to filter in.

There are many kinds of weather strips on the market, any one of which can be used with good results. Fig. 184 shows the way in which one kind is used in connection with window sash.

Door Seals. To open and close easily, any door must have a large crack around its edges when closed. Considerable cold air enters through such a crack. Therefore, when remodeling, one of the many types of weather strips available should be selected for all exterior doors.

When interior doors separate warm rooms from cold halls, or other unheated areas, the use of an automatic door bottom prevents drafts. Fig. 185 shows one such door bottom. When the door is closed, a felt pad automatically drops down to the floor, sealing the crack effectively. The advantages of such a device include confining

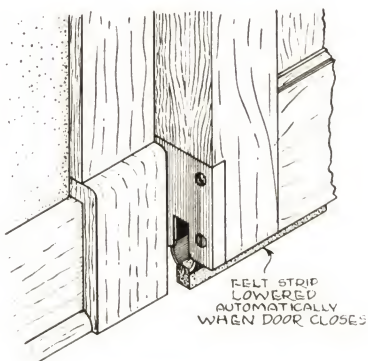


Fig. 185. Automatic Door Bottom

cold air to sleeping rooms where windows are open, keeping out noise, and preventing the spread of odors.

Double Glazing. During exceptionally cold weather, windows are apt to have a heavy coating of frost on the inside. When the warm and somewhat humid air of the interior comes in contact with the cold surface of the glass, a part of its moisture is deposited on the glass, for the temperature drop decreases the moisture capacity of the air. For example, air at 70° can hold a given amount of moisture. Should the temperature of this air be reduced considerably below 70°, as it is in coming in contact with the cold inside surface of the window glass, it cannot hold all its moisture. The excess amount is what forms the frost on windows. Where houses are equipped for positive humidification, a considerable amount of frost will be formed on the window glass.

To avoid this, it is necessary to prevent the glass from having a temperature so much lower than that of the air in the room. There are two ways of accomplishing this.

Storm windows, if fitted tightly into place, form a dead-air space between themselves and the inner windows. This space insulates the inside window glass, with the result that it does not get cold enough to chill the inside air and cause condensation or frost on the glass.

If new sash are contemplated, for any reason, in remodeling a house, the use of a double-glass window, as shown in Fig. 186, will accomplish the same results as storm windows.

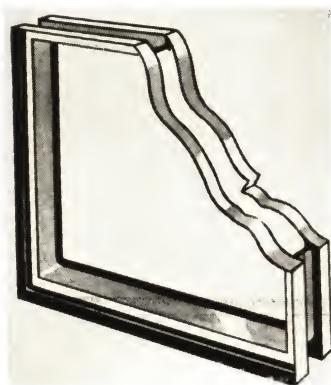


Fig. 186. Double-Glass Window

Courtesy of Libbey-Owens-Ford Glass Co., Toledo, Ohio

Storm Windows. In addition to preventing condensation on window glass, storm windows, if properly fitted, will reduce by about fifty per cent the amount of heat leakage through the cracks around the windows. In Tables A and B we see that the heat loss due to window cracks is large. Storm windows are worth while, then, since they reduce such losses by half.

If felt is fitted snugly between the edges of the storm window and the window pane, heat loss due to cracks around windows can be eliminated almost entirely. The disadvantage, however, is that storm windows fitted into place in this manner cannot be opened.

Storm Doors. Storm doors, properly fitted, will reduce the heat loss through cracks by approximately fifty per cent. They also avoid possible condensation on thin panels or on the glass of the inner door.

Calking. There are several kinds of plastic-like material offered for use in calking. Such materials are of about the same consistency as putty, but they do not dry out or harden.

Old brick houses are apt to have rather large cracks between the brickwork and the window and door frames. Calking should be used to seal these cracks, in order to prevent serious heat losses and infiltration of rain or dust. Calking can be used to seal any cracks, either in old or new construction.

CONDENSATION. Earlier in this chapter condensation, or the forming of frost on the interior surfaces of windows, was explained. Under certain conditions, a somewhat similar problem may arise in relation to interior wall and ceiling *surfaces*, and even *within* walls and ceilings. This problem is not new; it often used to be noticed in barns during severe winter weather, for instance. But only with the widespread use of modern heating has it become a general problem in houses.

Water stains on walls and ceilings are the common result of condensation, but often the damage done is more serious. Stain and decay in sheathing, studs, and roof members; loosened plaster; outside paint failures on siding, and door and window trim; and discoloration of brick and stone are other results of condensation. Therefore an important consideration, in remodeling houses and modernizing them to include present-day comforts, is some knowledge of the conditions under which condensation might develop and the means of preventing its development.

The following paragraphs discuss the principles involved in condensation, its causes, and its prevention. All through these explanations we use the term *moisture*, in the belief that its use might make it easier to understand these principles. From the engineering standpoint, moisture, as the term is used herein, really means vapor, and vapor is moisture in a gaseous stage.

Relative Humidity. In order to understand the cause of condensation we must be familiar with a principle which has to do with air and its moisture content. Air at any given temperature can hold a specific amount of water or moisture vapor, and this amount varies directly with the variation in temperature. Thus air at 70° is capable of holding more moisture than air at 60°; air at 50° is capable of holding more moisture than air at 40°, and so on.

It is seldom, however, that air contains the full amount of moisture which it is capable of holding. The term *relative humidity* is used to indicate how much moisture is in air at a given temperature, in relation to the moisture which air at that temperature could hold. For example, if air at 70° contains all the moisture it is capable of holding, we say its relative humidity is 100 per cent. If the same air at 70° holds about half as much moisture as it is capable of containing, we say that its relative humidity is 50 per cent.

Cold air, at temperatures near zero, is not capable of holding much moisture. Under ordinary conditions, its moisture content is

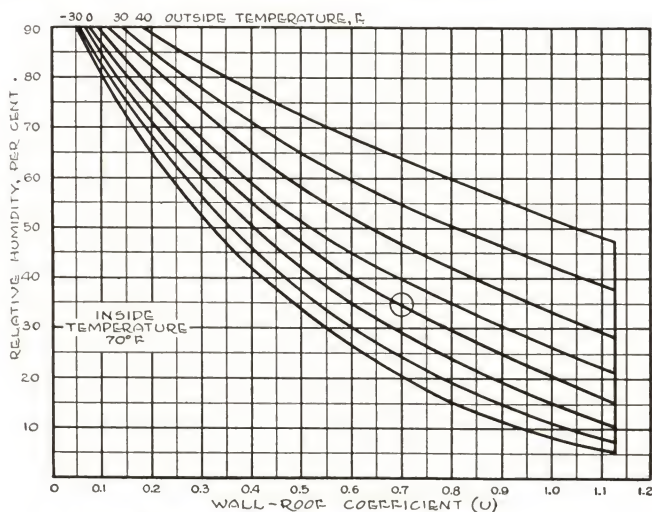


Fig. 187. Permissible Relative Humidities for Various Transmission Coefficients

Courtesy of A. S. H. V. E. Guide 1940

exceptionally low. If such air is heated and then supplied to the rooms of a house, it is easy to see that its relative humidity would be very low indeed. In other words, when cold air with its low-moisture content is heated to about 70°, it contains nowhere near the amount of moisture which 70° air is capable of holding. Thus its relative humidity is extremely low.

Warmed air with an extremely low relative humidity is neither comfortable nor healthful. This is why modern heating systems include provision for adding moisture to heated air before it goes to the various rooms of the house. This added humidity, while necessary

to comfort and health, increases the likelihood of condensation on the walls and ceilings. In order to enjoy the advantages of modern heating systems, therefore, certain protective measures must be taken against the possibility of condensation.

Permissible Relative Humidities. Trouble with condensation is rarely encountered in old houses, with the older heating systems, because the average humidity is low, unless a plumbing or steam pipe defect is supplying moisture to the air. Kitchens, laundries, and bathrooms often show condensation on walls and ceilings, because of the moisture or steam involved in their use. We explain how to meet this problem, a little later.

We need have no fear of condensation if the relative humidity is perfectly controlled. This is the first and best means, then, of combating the problem. Fig. 187 shows a chart, by the use of which we can determine the permissible relative humidities for various wall and ceiling constructions. Remember that the U values shown at the left in Fig. 187 offer greater heat resistance than those at the right.

Example. Suppose the outside temperature is zero, and the U value for a wall is .70. To find the maximum safe relative humidity, locate the 0.7 (this is the same as .70) on the chart in Fig. 187 and follow the vertical line above 0.7 until it intersects the curved 0° line. From this point of intersection, follow the horizontal line to the left side of the chart. The 35 indicates that 35 per cent relative humidity is the maximum amount permissible, and that if the relative humidity goes higher than 35 per cent, condensation is bound to occur.

In the above example, if the outside temperature were zero and if 35 per cent relative humidity were desirable, then the wall or ceiling must have a U value equal to 0.7 or .70. Most any type of a wall, for example, has a U value better (lower) than .70, so we see that with relative humidities of 35 per cent or less, no condensation is possible. A study of the chart will show that in most cases only exceptionally high relative humidities will cause condensation when average U values exist. Also we see that where walls offer little heat resistance not much relative humidity can be present without danger of condensation.

When Condensation Occurs. Condensation will occur on the inside surface of walls and ceilings, when the inside air is cooled to below its dew point by coming in contact with these surfaces. In other

words, if air at 70° comes in contact with a very cold wall or ceiling surface, it is chilled to a lower temperature. If this air had a high relative humidity at 70° , then, because air cooled to below 70° cannot hold as much moisture as when it was 70° , some of the moisture from the chilled air is deposited on the colder surface of the wall or ceiling.

In addition to surface condensation, just described, it is possible, under somewhat similar conditions and for the same reasons, for condensation to occur *within* the walls of a house. Instead of the moisture condensing on the interior surfaces, in other words, it may penetrate the inner surfaces of the wall and collect on, say, the sheathing.

Sometimes roofs are insulated with a type of insulation that leaves an air space between the insulating material and the bottom

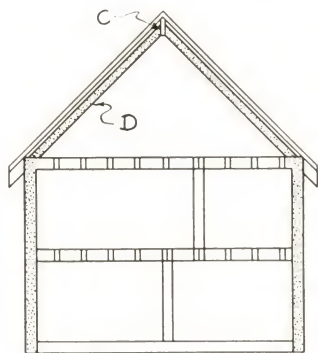


Fig. 188. Insulation Used in Roof

sides of the roof boards. For example note Fig. 188. If the insulation is not packed tightly against both sides of the ridge board, *C*, some of the warm air which leaks through the insulation will get between the insulation and the roof boards, and cause considerable condensation.

How to Prevent Condensation. As far as inside surface condensation on walls is concerned, the problem is not of much importance because it seldom occurs. Fig. 187 shows that for a relative humidity of 50 per cent, even, and this is higher than necessary, the required *U* value is .40 when the outside temperature is -10° . Walls of average construction, even without insulation, have *U* values better (lower) than .40. As a matter of fact a plain frame wall, composed of wood siding, wood sheathing, 2x4 studs, and wood lath and plaster, has a *U* value of .24. (See Example 2, previously explained relative to Fig.

179.) Therefore, it is evident that even without insulation there is no surface condensation problem, unless relative humidity goes very high.

It is best, however, always to check the U values in connection with the proposed relative humidity, to make sure of a sufficiently low U value.

Sometimes the humidifying apparatus in a heating system supplies much more humidity than is necessary. If that happens, some condensation is likely, although if a wall is insulated to prevent heat losses, its U value still is, in most cases, sufficient. However, humidi-

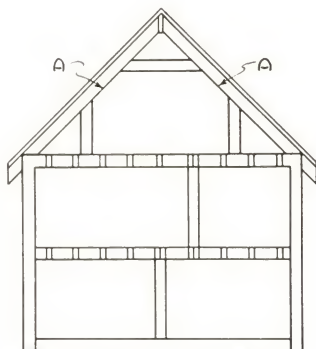


Fig. 189. Portion of Attic Room in Contact with Roof

fiers should be checked now and then by the use of a humidity gauge, which can be purchased quite cheaply.

If during certain operations in kitchens, bathrooms, or laundries some condensation seems likely, a window or two may be opened. Thus condensation is prevented by ventilation.

Where the ceilings of heated attic rooms are similar to A in Fig. 189, insulation will generally be necessary in order to prevent condensation. In such cases, use Fig. 187 to determine what U value is required when the humidity and outside temperature are known. Then insulate the ceiling-roof construction to meet the required U value.

Ceilings under cold attic areas often require insulation to prevent condensation. The required U value can be obtained using insulation as explained in the foregoing.

Prevention of condensation on the interiors of walls is explained

in the following paragraphs. For illustrative purposes we assume that fill-type insulation is used in the walls. This does not constitute a recommendation, but is simply the means chosen to explain the theory. Manufacturers of other insulations having moisture barriers will gladly supply literature in relation to their own particular products.

Condensation within walls does not often happen in old houses. It is more likely to happen in remodeled houses, where weather stripping, caulking, storm windows and doors, together with insulation, have been used to give the house what might be called "tight construction." In houses with this tight construction, plus humidifying apparatus, there is higher relative humidity in the house, and less chance for it to escape. Hence the danger of its penetrating into the walls. Therefore, we ought to plan the construction in all remodeled

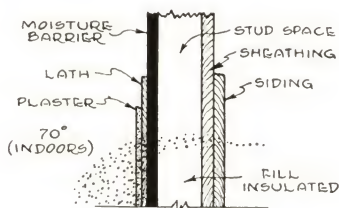


Fig. 190. Recommended Placement of Moisture Barriers in New Walls of Remodeled Houses

houses so that the *inner* or warm surface of the walls will be highly resistant to the passage of moisture. At the same time the outer or cold side of the walls should *not* be resistant to the flow of moisture, so that if any moisture does penetrate the wall from the inside it will more readily escape to the outside air.

Fig. 190 shows the recommended placement of the moisture barrier in new walls on remodeling jobs, and also shows the effectiveness of the moisture barrier in reducing the flow through the wall. The moisture is indicated by dots. Note that no moisture barrier is shown on the cold, or outside surface of the wall.

Where the modernization of a house does not require new walls or where access to the walls is not possible, a moisture barrier may be created by painting two coats of aluminum paint on the interior surface of the plaster.

For new walls the barrier may consist, for example, of a layer

of asphalt-impregnated and glazed paper, such paper to weigh at least 50 pounds per 500 square feet of the paper. This type of barrier as shown in Fig. 190, should be installed from the inside (over any insulation) before the lath and plaster are applied.

Fig. 191 shows a detailed view of how moisture barriers are used in connection with fill-type insulation.

In modernizing houses where the side walls are not to be disturbed and where fill insulation is blown in between the studs, condensation

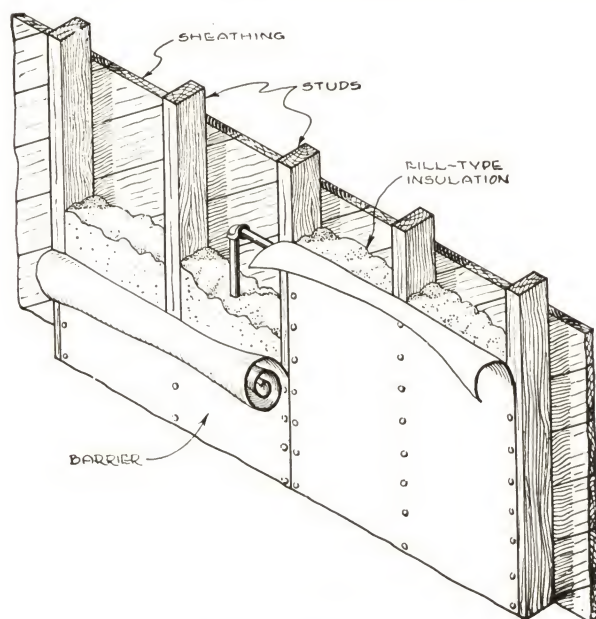


Fig. 191. Application of Moisture Barrier

can also be avoided to some extent by not replacing the plugs (holes made in sheathing through which to apply the fill by pressure and hose), but simply covering them with moisture-permeable slater's felt before the siding is replaced. This allows some ventilation and the escape of moisture vapor.

Condensation on the underside of roof boards over unheated attics, as at *A* in Fig. 174, can be retarded and in many cases prevented by adequate attic ventilation. The necessary ventilation may be obtained by the use of louvres, see Fig. 174.

QUESTIONS AND ANSWERS

The following questions and answers serve the purpose of a short review:

1. What is meant by the term *dew point*?

Answer. The term *dew point* is applied to the temperature at which condensation occurs. Or, it is the temperature at which air can no longer hold its moisture but must deposit some in the form of condensation.

2. What is meant by *relative humidity*?

Answer. The amount of moisture in the air at any given temperature is referred to as the relative humidity. All air contains moisture, and the capacity of air to retain it varies with the temperature. The warmer the air, the more moisture it can carry. Suppose the air temperature in a living room at 6:00 A.M. is 50°F. and the relative humidity is 60 per cent. That means the air is carrying only 60 per cent as much water vapor as it can hold at 50°F. Now, the heating plant starts to deliver heat, and a half hour later the room temperature is up to 70°F. With no water taken out of, or added to the air, the relative humidity has dropped to 30 per cent. In other words, the actual amount of moisture in the air has remained constant for both conditions, but is represented by a lower percentage in the second case, since air at 70° can carry more moisture than air at 50°. At night the process is reversed. The heating plant shuts off, the air temperature drops, and as it drops, its capacity to hold moisture is reduced also. It follows that if no moisture is added or taken away, the relative humidity increases as the air becomes cooler.

3. Where is condensation apt to appear in walls?

Answer. Under adverse conditions, drops of water (or frost if the outside temperature is cold enough) form along the inside surface of the sheathing. This is due to the fact that the sheathing is cold enough to reduce the temperature of the moisture-laden air to the point where it is no longer able to carry all of the vapor it originally contained. As a result, the air must give up the excess moisture, which is deposited on the cold surface of the sheathing.

4. Where is the condensation apt to appear in attics?

Answer. Condensation in attics may occur in the same manner as in side-walls, except that the excess moisture in the air is condensed on the underside of the roof rafters or roof deck when the moisture-laden air comes in contact with these cold surfaces.

5. Is insulation responsible for condensation?

Answer. No! Insulation is not responsible for condensation. Condensation may occur in uninsulated homes if high indoor relative humidities are maintained during periods of extremely cold weather.

6. What type of insulation can be used for outside walls in a modernizing job where the walls are not to be altered? How is it applied?

Answer. If walls are not to be altered, a fill-type insulation must be used. It is blown into place by a pressure hose.

7. How can two air spaces be made between studs when using blanket insulation?

Answer. Some blankets have flanges on their edges which can be bent so that the blanket is about midway between lathing and sheathing, thus leaving an air space on each side.

8. How much heat is represented by one B.t.u.?

Answer. The amount of heat required to raise one pound of water 1°F.

9. What does $(t - t_o)$ mean, and how is it calculated?

Answer. This symbol means temperature difference between inside and outside air. It is calculated by subtracting the outside temperature t_o from the inside temperature t .

10. How are R values calculated?

Answer. Every building material, including insulations, air spaces, and inside and outside surfaces, has what are called k values. To find the R value for any material divide 1 by the k value.

11. How are U values determined?

Answer. When the R values for all materials, air spaces, and inside and outside surfaces have been calculated, add them and divide 1 by their sum.

12. When calculating heat loss through a wall, how is the area of the wall found?

Answer. Multiply width times length. This gives the *gross* area. Subtract the combined areas of all windows and doors from the gross area. This gives the *net* area which is used in all heat-loss calculations.

13. Why are window and door areas subtracted from gross wall areas?

Answer. The U values for windows and doors are much different from other materials and for this reason the heat losses for them must be calculated separately. Also the insulations used in walls cannot be used in windows or doors.

14. When determining U values for floors what deviation is made from the process used in considering walls?

Answer. Floors do not have either side exposed to the outside air and wind. Therefore the surface value (f_t) is used for both surfaces.

15. How is the R value for $\frac{3}{4}$ -inch pine calculated?

Answer. The k value for pine is .80. Then the R value is $1 \div .80$ or 1.25. However, the k values in Table 4 are *per inch*. Thus for $\frac{3}{4}$ -inch pine the R value is $1.25 \times \frac{3}{4}$ or $1.25 \times .75 = .9375$ or .94.

16. What is the U value for a wood door $1\frac{1}{2}$ inches thick and having thin wood panels?

Answer. The U value is 1.13. See note under Table 6.

17. How is the lineal footage of cracks around a double-hung window determined?

Answer. A double-hung window has two sides, a top, a bottom, and a meeting rail where the top and bottom halves meet. Add the lengths of the two sides to the combined lengths of top, bottom, and meeting rail.

18. What is the U value for cracks around windows and doors?

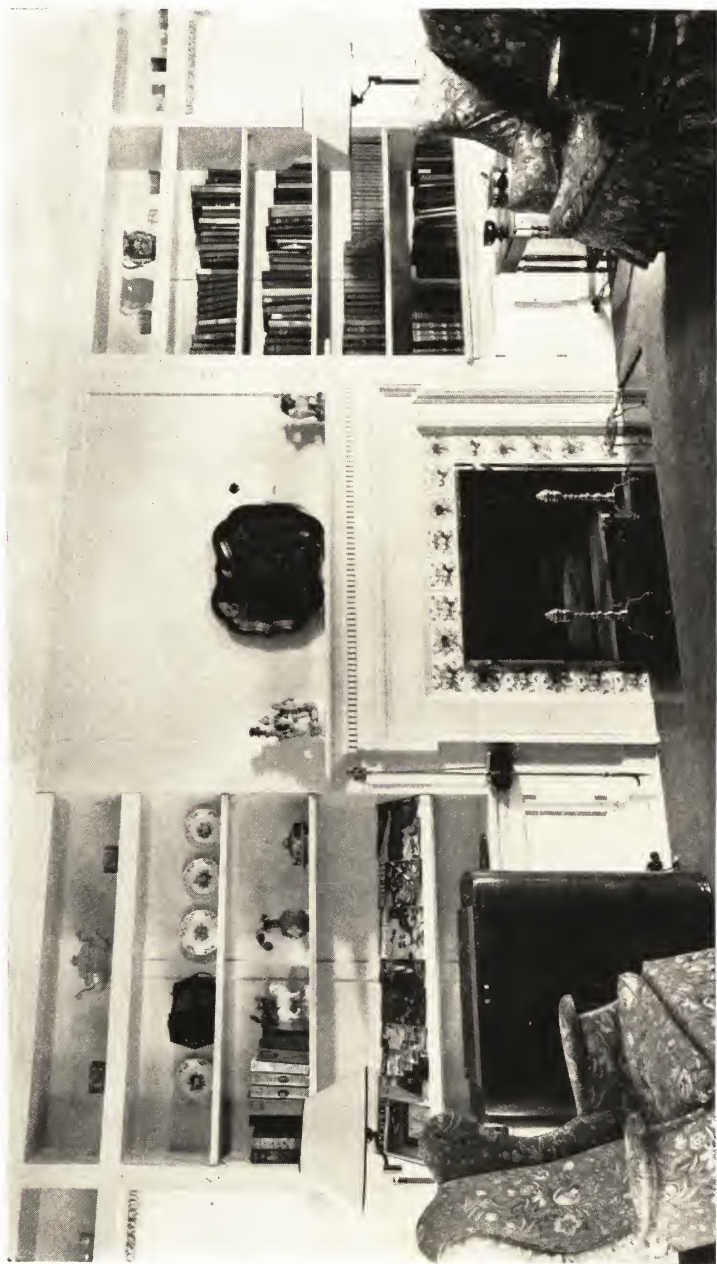
Answer. For average weather-stripped windows and doors a U value of .51 can be used.

19. How can attics be ventilated to avoid condensation?

Answer. By building louvres at each end to provide for air movement.

20. How can frame walls using fill insulation be ventilated?

Answer. If the fill insulation were put in by means of a pressure hose, the holes through which it was blown can be left without plugs, being covered only with slater's felt and the siding. This will provide adequately for ventilation.



GEORGIAN FIREPLACE AND MANTEL WITH BUILT-IN BOOKSHELVES

Courtesy of Curtis Companies, Incorporated, Manufacturers of Curtis Woodwork, Clinton, Iowa

CHAPTER X

Selection of Materials

CAREFUL designing of floor plans and elevations, and thoughtful planning of rooms, halls, closets, and stairs, together with good construction, are matters of primary importance to the basic value of any remodeling job. However, the good taste and common sense used in the selection of materials create that final effect by which the charm, soundness, and worth of a remodeled house are judged.

This chapter presents a discussion, more or less in outline form, to aid you in visualizing the places where new materials may be required in remodeling, the typical materials available for such requirements, how new materials can be used in conjunction with the old, and other information which may be helpful in the study of materials and their applications.

In remodeling work, whether complete or partial, there are many places where you are likely to need new materials in order to satisfy your remodeling requirements. So that you may visualize these places, and at the same time have some idea as to suitable and available materials, the following outline is presented.

Fig. 192 is a perspective section or cutaway view of a typical remodeled house. Parts of the roof, one outside wall, the foundation, and some interior partitions have been omitted so as to show the interior as well as the exterior of the house. This illustration was drawn in order to show two exterior treatments for outside walls, and to show other applications of materials. In other words, this is a special drawing for illustrative purposes. Not all the possible places for the use of new material can be shown in Fig. 192, but those which are visible will help you picture those which are not.



MATERIALS FOR ATTICS. Floors. See 1 in Fig. 192. The flooring used in the attic, when the attic is merely a storage space, can be an inexpensive flooring, tongued and grooved for close fit.

Typical Kinds

- | | |
|----------------|------------------|
| 1. Yellow pine | 4. Western larch |
| 2. Cypress | 5. Redwood |
| 3. Douglas fir | |

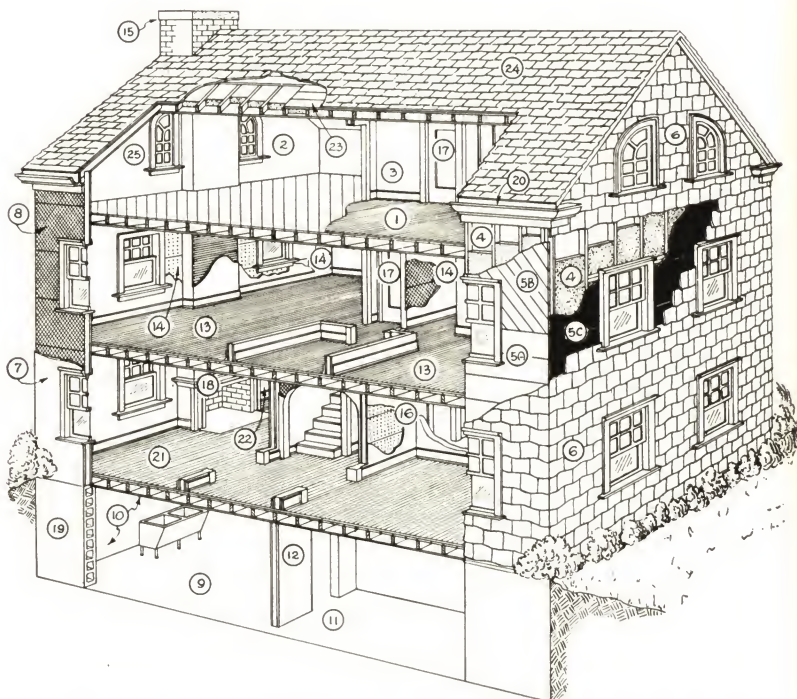


Fig. 192. Perspective Section of House, Showing Where Materials May Be Used in Remodeling

Walls and Ceilings. See 2 in Fig. 192. When the attic is used as a storage space only, walls and ceilings are often left unfinished. However, sheathing of some sort will make the attic cleaner and warmer, and thus better suited to its miscellaneous uses.

Typical Kinds

- | | |
|--------------------------------|----------------------------------|
| 1. Plywood | 4. Miscellaneous building boards |
| 2. Insulation (see Chapter IX) | 5. Miscellaneous pressed woods |
| 3. Sheet rock | 6. Miscellaneous paneling |

Playroom Floors. See 1 in Fig. 192. When an old attic space is being remodeled to make a playroom or recreation area there are several floor materials which may be used directly over the old flooring.

Typical Kinds

- | | |
|---------------------------|--------------------|
| 1. Linoleum | 5. Rubber tile |
| 2. Various kinds of oak | 6. Asphalt tile |
| 3. Various kinds of maple | 7. Western hemlock |
| 4. Birch | |

Playroom Walls and Ceiling. See 3 in Fig. 192. In an old attic space to be remodeled into a playroom, the following materials may be used successfully if no finishing material has been previously used.

Typical Kinds

- | | |
|--------------------------------|--------------------------------|
| 1. Plywood | 4. Insulating tile |
| 2. Insulation (see Chapter IX) | 5. Miscellaneous pressed woods |
| 3. Lath and plaster | 6. Linoleum |

MATERIALS FOR OUTSIDE WALLS. Insulation. See 4 in Fig. 192. Insulation for outside frame walls can be selected from a large group of available materials, as explained in Chapter IX.

Sheathing. See 5A, 5B, and 5C in Fig. 192. Sheathing for frame walls can be selected from a large group of typical materials, some of which are insulating and fireproof.

Typical Kinds

- | | |
|---|----------------|
| 1. At 5A various kinds of sheet insulation (see Chapter IX) | |
| 2. At 5B dragon wood sheathing | |
| a) Cedar | d) Yellow pine |
| b) Cypress | e) Fir |
| c) Redwood | f) Poplar |
| 3. At 5C various kinds of asphalt coated sheathing | |

Siding. See 6 in Fig. 192. In many cases old siding is so badly weather-beaten and in such poor condition, that it cannot be made to fulfill requirements as to appearance. Or, where a house is being enlarged, it may be impossible to duplicate the old siding for the additional walls, thus necessitating all new siding. If a house is being altered in architectural style, it might be necessary to replace the old siding with material conforming more nearly to the chosen architectural type. In any event, there are several siding materials from which a selection can be made.

Typical Kinds

1. Asbestos siding—selection of colors
2. Asphalt shingles—selection of colors
3. Asbestos shingles—selection of colors
4. Wood siding
 - a) Cedar
 - b) Cypress
 - c) White pine
 - d) Sugar pine
 - e) Western pine
 - f) Redwood
 - g) Hemlock
 - h) Poplar
5. Cedar shingles



Left, Fig. 193A. Typical Old House

Courtesy of Red Cedar Shingle Bureau, Seattle, Wash.

Right, Fig. 193B. House of Fig. 193A Showing Use of Cedar Shingles in Remodeling

Courtesy of Red Cedar Shingle Bureau, Seattle, Wash.



Figs. 193A and 193B show how cedar shingles were used to modernize the siding in a typical remodeling job.

Stucco. See 7 and 8 in Fig. 192. The stucco, 7, and metal lath, 8, can be purchased from any building material yard.

Typical Kinds

1. Oriental exterior stucco
2. Red Top stucco lath

Brick Veneer. For veneering, a good quality face brick should be used. This material comes in a wide variety of colors which can be blended with the colored mortar between joints. Veneer should be anchored to the sheathing.

MATERIALS FOR BASEMENTS. Floors. See 9 in Fig. 192. In laundries and furnace rooms good concrete floors, well drained, are suitable. These will stand up under the rather hard usage they receive.

Walls and Ceilings. See 10 in Fig. 192. In laundries and furnace rooms the walls and ceilings may be left unfinished except to apply a coat of mortar to the foundation. However, a more pleasing and healthful basement can be had by applying furring to the foundations and using some form of sheathing.

Typical Kinds

1. Insulation (see Chapter IX)
2. Plywood
3. Pressed woods
4. Lath and plaster
5. Sheet rock



Fig. 194A. Typical Old Basement

Courtesy of Douglas Fir Plywood Association, Tacoma, Wash.

Playroom Floors. See 11 in Fig. 192. There are a number of flooring materials which can be used for a basement playroom, depending on the condition of the old floor.

Typical Kinds

1. Linoleum over old concrete
 - a) Basement must be dry and concrete smooth.
2. Oak or maple flooring over old or new concrete
 - a) Furred above concrete
3. Carpets over concrete
 - a) A heavy felt pad used between concrete and carpet—basement must be dry.

4. Terrazzo
 - a) Made in conjunction with new or old concrete floor
5. Linoleum over wood or old or new concrete
6. New concrete painted
7. Various kinds of soft tile over old concrete or wood over concrete.

Playroom Walls and Ceilings. See 12 in Fig. 192. If any surfacing materials are used on the foundations, furring should be done to avoid dampness.



Fig. 194B. Basement of Fig. 194A Showing Use of Plywood on Walls and Ceiling
Courtesy of Douglas Fir Plywood Association, Tacoma, Wash.

Typical Kinds

- | | |
|--------------------------------|------------------|
| 1. Lath and plaster | 4. Sheet rock |
| 2. Insulation (see Chapter IX) | 5. Plywood |
| 3. Pressed woods | 6. Wood paneling |

Figs. 194A and 194B show how an old basement space was remodeled into a playroom, using plywood on walls and ceilings.

BATHROOM MATERIALS. Ceiling. Ordinarily such ceilings are plastered and enameled. However, there are several other materials which may be used.

Typical Kinds

- | | |
|---------------------|------------------|
| 1. Lath and plaster | 3. Pressed woods |
| 2. Linoleum | |

Other sheet materials can be examined at any material salesroom.

Floors. Bathroom floors must be able to resist frequent wetness, high humidity, and habitual cleaning.

Typical Kinds

1. Tile

2. Linoleum

Walls. Bathroom walls must be able to stand steam, frequent cleaning, and water.

Typical Kinds

1. Tile

8. Waterproof wallpaper

2. Linoleum

9. Coated fabrics

3. Pressed woods

10. Metal tile

4. Lath and plaster—enameled

11. Rubber tile

5. Structural glass

12. Special woods

6. Marble

13. Cork carpet

7. Enamel

MATERIALS FOR BEDROOMS. Floors. See 13 in Fig. 192. Bedroom floors may be considered mostly from the standpoint of appearance, as ordinarily they do not have hard use. Beautiful finishes, therefore, can be maintained.

Typical Kinds

1. Wood

a) Hard maple

d) Birch

b) Red and white oak

e) Yellow pine

c) Walnut

f) Fir

Floors in the new portions of a house should be double—rough and finish floors.

2. Linoleum. Old wood floors should first be railed and sanded. Felt should be placed between the wood and the linoleum.

3. Carpeting. This can be applied over old wood floors.

4. Various wood or other soft tiles

Walls and Ceilings. See 14 in Fig. 192. If paper is required for bedroom walls and ceilings, lath and plaster form the best surfacing. Various enamels and paints also work best with plaster.

Typical Kinds

1. Lath and plaster

3. Plywood

a) Lath can be some form of insulation (see Chapter IX), a sheet, or wood, or metal type.

4. Various pressed woods, insulating tiles, etc.

5. Recessed-edge sheet rock

2. Wood paneling

6. Various "planks"

A great many manufactured materials of this type may be seen at any material salesroom.

CLOSETS. Closets may be plastered or may have some kind of manufactured sheathing for surfacing. Sometimes cedar is used as a lining, to repel moths. Closets should be painted and should have the same type of flooring as the adjoining room. Equipment in closets may consist of shelving, clothes rods, and shoe racks. Special clothes-hanging devices are also obtainable. An electric light is a good feature in a closet.



Fig. 195. Typical Standard Millwork China Cabinet
Courtesy of Curtis Companies, Inc., Clinton, Iowa

CHIMNEY. See 15 in Fig. 192. Any part of a chimney visible from the outside should be made with an outer course of face brick. All other parts can be constructed of common brick. The flues should be lined. Round linings are most efficient. The top of a chimney may have a stone or concrete cap, or a variety of "pot." See Chapter I.

CHINA CABINETS. A great amount of charm is added to dining rooms, for example, by the use of well-designed cabinets, either built

in the walls, or tucked into corners. Fig. 195 shows a typical cabinet. Large woodworking mills have such items in stock; and their entire line can be studied in their catalogs.

MATERIALS FOR DINING ROOMS. Floors. Old wood floors can be covered with linoleum or carpet.

Typical Kinds

1. Red or white oak
2. Linoleum
3. Allover carpeting



Fig. 196. Typical Modern Interior View



Fig. 197. Typical Modern Exterior Door

Courtesy of Curtis Companies, Inc., Clinton, Iowa

Walls and Ceiling. See 16 in Fig. 192.

Typical Kinds

1. Lath and plaster
2. Wood paneling
3. Plywood

DOORS. See 17 in Fig. 192. Doors should be selected from standard sizes and qualities, as listed in mill catalogs. This will avoid the high cost of special millwork. Figs. 196 and 197 show modern interior and exterior views.

ARCHES. Arches are used over openings between rooms where no door is required. The arch may be plastered only, or it may have standard trim. You can buy metal arches, ready to be installed and plastered. A typical kind is called Red Top. Arches with trim can be constructed by the carpenter.

FIREPLACES. See 18 in Fig. 192. Parts of fireplaces can be purchased ready to be installed. Manufacturers' catalogs of standard



Fig. 198A. Typical Fireplace. Note Crack in Wall Plaster

Courtesy of Western Pine Association, Portland, Oregon

parts may be obtained and studied for ideas. Figs. 198A and 198B show a typical fireplace, made with face brick and a wood mantel (before and after modernizing the wall with wood paneling). Fire-brick must be used as lining for the fireplace. The hearth can be of brick, tile, or concrete. Fireplaces can be plastered, faced with marble, or finished in other ways.

FOUNDATIONS. See 19 in Fig. 192. Modern foundations are made of concrete or concrete blocks. The thickness depends on local building laws. Foundations can be waterproofed by mopping asphalt on the outside surface or by first applying a coat of mortar, and then the asphalt. Footing drain tile also helps keep basements dry.

GUTTERS. See 20 in Fig. 192. Generally gutters are made or lined



Fig. 198B. Use of Wood Paneling to Modernize Wall
Shown in Fig. 198A

Courtesy of Western Pine Association, Portland, Oregon

with copper or galvanized iron. Copper has the advantage of never wearing out. Wood gutters are also obtainable.

AIR CONDITIONING. (See Chapter XIII.)

HEATING. (See Chapter XIII.)

INSULATION. (See Chapter IX.)

GLASS. Part of the charm and beauty desired in a remodeled house may be secured by a generous use of glass. Typical

places where glass can be used to advantage are listed as follows:

Typical Places

1. Ample and wide windows
2. Built-in plate glass mirrors in doors, over bookcases, in dressing tables, in wall niches, etc.
3. Covering an entire wall in small bedrooms
4. Shelves in bathrooms
5. Double glazing for windows
6. Storm windows
7. Corner windows. This makes for more sunlight and better views.
8. Picture windows. There are full-length windows extending down almost to floor level. They seem to enlarge a living room and provide a "picture" view.
9. Decorative glass-block partitions
10. Wainscoting of glass
11. Wall mirrors in dining rooms reflecting the table
12. Mirrors above sinks and lavatories
13. For shower stalls

MATERIALS FOR KITCHENS. Ceilings. Ordinarily, kitchen ceilings are of enameled plaster. However, other materials are available.

Typical Kinds

- | | |
|------------------------------|------------------|
| 1. Lath and plaster—enameled | 3. Pressed woods |
| 2. Linoleum | |

Floors. Linoleum forms the most acceptable surfacing for kitchen floors, because it is comfortable to walk and stand upon, and cleans easily.

Walls. Kitchen walls, like those of a bathroom, are subject to a large amount of steam and to high humidity. They should be covered with material that can be cleaned often and easily.

Typical Kinds

- | | |
|---------------------|--|
| 1. Plaster—enameled | 3. Pressed wood and other manufactured surfacing |
| 2. Linoleum | |

Fig. 199 shows a kitchen where pressed wood has been used for the walls.

LATHING. The type of lathing to use is determined to a great extent by considerations relative to insulation. Several kinds of materials are made for this purpose. See Chapter IX.

Typical Kinds

1. Insulating blocks and sheets
2. Wood lath
3. Metal lath
4. Several manufactured sheets such as Rocklath and sheet rock

MATERIALS FOR LIVING ROOMS. Floors. See 21 in Fig. 192.

The treatment of floors in living rooms should be given special care, because in most houses the living room is the showplace, the place where guests are entertained and where the most leisure hours are spent.

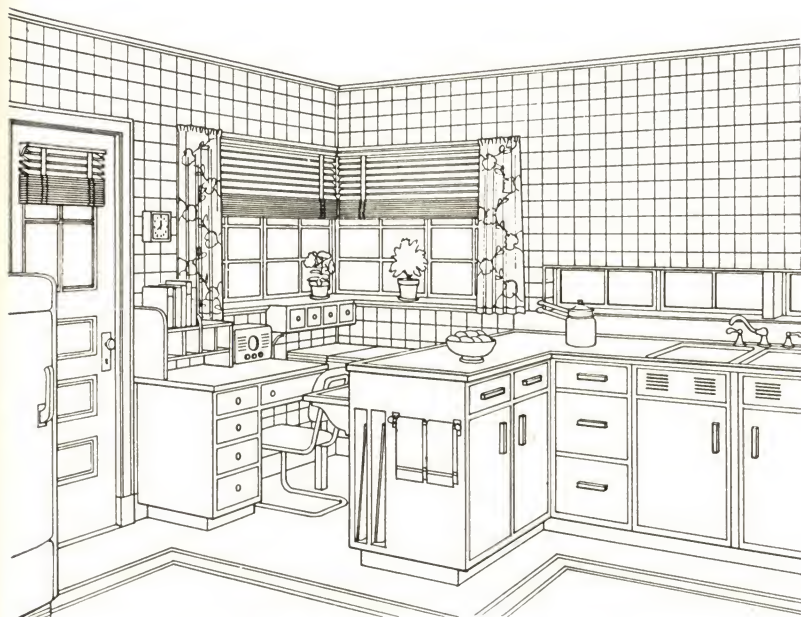


Fig. 199. Use of Pressed Wood on Kitchen Walls

Courtesy of Masonite Corporation, Chicago, Ill.

Typical Kinds

1. Wood tiles or blocks—available in several kinds of wood—mostly oak
2. Linoleum
3. Hard maple—prime and standard
4. Red and white oak—prime and standard
5. Birch
6. Walnut
7. Beveled oak planks
8. Random-width plank flooring in oak and other woods
9. Soft tiles such as rubber, cork, and asphalt
10. Carpeted floors with wood floor of hard pine or maple

Oak flooring may be purchased quarter-sawed or plain. The quarter-sawed is the more pleasing in effect.

Fig. 200 shows a pleasing treatment for a living room floor. This was accomplished through the use of wood tiles.



Fig. 200. Pleasing Treatment for Living Room Floor
Courtesy of E. L. Bruce Company, Memphis, Tenn.

Walls. See 22 in Fig. 192. Most living rooms have lath and plaster walls. However, there are other surfacing materials which can be used with pleasing and satisfactory results.

Typical Kinds

- | | |
|--|--|
| 1. Lath and plaster | 4. Recessed-edge sheet rock—paint or paper |
| 2. Wood paneling—various grains and colors | 5. Felted wood panels—selection of colors |
| 3. Various "planks," tiles, etc.—selection of colors | |

Figs. 198A and 198B show how, in a remodeling job, wood paneling was used over badly-cracked walls.

Living room ceilings may be treated in much the same manner as the walls.

LUMBER. Lumber for structural work in a remodeling job must be kiln-dried to avoid separation of the new parts from the old, shrinkage cracks, sagging of doors and windows, and other undesirable effects. So-called green lumber must be avoided. The use of old lumber is feasible, if it is in good condition, because it is already dried and will not shrink further.

Roof Boards. See 23 in Fig. 192. Roof boarding can be selected from several materials, to fit the needs.

Typical Kinds

- | | |
|----------------|---------------------------------------|
| 1. Wood boards | c) Western larch |
| a) Yellow pine | 2. Insulating sheets (see Chapter IX) |
| b) Douglas fir | 3. Fireproof boards |

For roof insulation see Chapter IX.

Roofing. See 24 in Fig. 192. Various kinds of shingles form pleasing roofs. Wood shingles are prohibited in some localities, because of the fire hazard.

Typical Kinds

- | | |
|---|--|
| 1. Cedar | 3. Asphalt—various colors and patterns |
| 2. Rolled roofing—various colors and patterns | 4. Tile—various shapes and colors |

Stairs. See Chapter VIII.

Standard Lengths and Widths. Practically all lumber, insulation, planks, boards, and sheets are cut or manufactured in standard widths and lengths. These conform to the standard spacing, 16" on center, for studs, joists, and rafters.

Standard Millwork. Most items such as window and door frames, windows, doors, trim, cabinets, shutters, stairs, French doors, telephone cabinets, ironing boards, mantels, and like details can be

purchased from stock in many woodworking mills. Standard mill-work comes ready for installation and should be used wherever possible.

Windows. Beautiful windows add to the charm of a house both inside and out. They should be selected, and also placed, in keeping with the chosen architectural type.



Fig. 201. Modern Double-Hung Window with Shutters
Courtesy of Curtiss Companies, Inc., Clinton, Iowa

Typical Kinds

- | | |
|--|---------------------------------------|
| 1. Casement windows—wood, steel, and aluminum sash | 4. Attic windows (see 25 in Fig. 192) |
| 2. Double-hung windows—mostly wood sash | 5. Ventilating windows |
| 3. Basement windows | 6. Picture windows |
| | 7. Bay windows |

Fig. 201 shows a modern double-hung window with shutters.

Your study of this chapter could be supplemented by visiting material salesrooms or yards and by writing for manufacturers' catalogs. Architectural magazines carry advertisements which give the names and addresses of manufacturers. Local telephone directories list them, also.

HOW NEW MATERIALS MAY BE USED WITH OLD

Often in remodeling work, new materials can be used along with the old in such a manner that the desired results can be accomplished without removing or greatly disturbing the old work. To do this constitutes an appreciable saving in labor and time and is therefore worth your careful attention. In the following, typical instances are explained.

FLOORING. The new flooring may be of wood, linoleum, some form of tile, concrete, or other materials. Any of these floorings may be installed without a great deal of preparation as far as the old floors are concerned.

Wood. Let us assume that the flooring in an old living and dining room is in bad condition and that a new oak surfacing is planned. In some cases a thin oak flooring ($\frac{3}{8}$ " approximately) would be selected. It is not necessary to remove the old floor; however, the old work should be carefully railed where necessary. Also care should be exercised to see that the old work is level throughout. The new flooring can then be nailed directly to the old, with a layer of building paper between.

In addition to the savings in labor and time this procedure tends to make the flooring more soundproof and sturdy, and to prevent dust from coming up through cracks.

Board-form flooring, of any kind of wood, may be installed in like manner.

Wood and Other Soft Tile. Where wood tile somewhat like that shown in Fig. 200, or other soft tile, is to be installed, the old flooring must be railed and leveled as for board flooring. In some instances sanding is necessary to make the old work smooth. The tiles can then be nailed or cemented into place.

Linoleum. For linoleum, the old flooring should be given the same treatment as for soft tile, after which the felt and linoleum can be cemented down.

Concrete. Sometimes wood, linoleum, or new concrete surfaces are used over concrete floors. Again, the new application can be made without much preliminary work, if the old floor is level and not badly cracked.

Let us assume that a new oak or maple flooring is to be laid in a

basement playroom where there is an existing concrete floor. The first step consists of nailing furring strips to the floor, if possible, or bolting them with special bolts made for the purpose. These strips should be 2"x2", spaced 16" on center. The flooring is nailed directly to the furring.

Linoleum can be cemented directly to the surface of the concrete. However, linoleum should not be used unless it is certain the concrete will never become damp.

In rare cases the topping (thin layer of mortar applied to concrete to provide a smooth surface) becomes badly cracked and separated from the main portion of the underlying concrete. This situation can be repaired without having to pour an entirely new floor.

As much as possible of the topping should be removed with the tools which concrete contractors use for this purpose. The surface of the remaining concrete should be roughened, and water applied to remove all loose material and dust. The surface should be kept wet some hours in advance of pouring the new surfacing. The mix for the new surfacing may consist of one part sand and one part cement. It should be applied at least an inch thick. The surface may be troweled smooth.

SIDING. Suppose that an old house has narrow wood siding on the outside walls, and that new siding, such as asphalt or asbestos shingles, is planned in remodeling. The new siding may be applied directly over the old without any preliminary work, other than to make sure that the old work is properly nailed.

SHINGLES. Old houses often have wood shingles which are in poor condition. In such cases new roofing material, such as asphalt or asbestos shingles, or rolled roofing can be applied directly over the old shingles. A few of the old shingles may have to be nailed down or removed if they are loose or curled, otherwise no preliminary preparation is required.

WALLS AND CEILINGS. Wood paneling, pressed wood, and various kinds of insulating tiles, boards, and sheets are frequently used in remodeling, for walls and ceilings. An instance is illustrated in Figs. 198A and 198B. It is not necessary to remove all of the old plaster before applying the new material. Only the loose or badly-cracked plaster need be removed. The new material is nailed through the lath and plaster so that the nails will be held by studs or joists. Fig. 202



Fig. 202. Basement Before and After Remodeling into Pleasing Recreation Room, Through Use of Insulating Board

Courtesy of Wood Conversion Company, St. Paul, Minn.

illustrates how a ceiling looked before and after such new material was used over the old plaster. In some instances furring strips are nailed to the ceiling, and then the new material is nailed to them.

BATHROOM FLOORS. Wood floors in old bathrooms are most often modernized by using linoleum or vitreous tile.

Linoleum can be cemented down on the old wood floor as we have already explained.

However, when vitreous tile is to be applied to a bathroom floor, the old wood flooring must be removed. Drop flooring is then installed between the joists as shown at the right in Fig. 203. The tops of the joists are beveled and covered with wire mesh. Concrete is poured over the drop flooring, and the tile is placed on the concrete.

BATHROOM WALLS. Linoleum, pressed wood, vitreous tile, and various other materials are used to modernize bathroom walls.

For linoleum the walls can be roughened, if they were originally

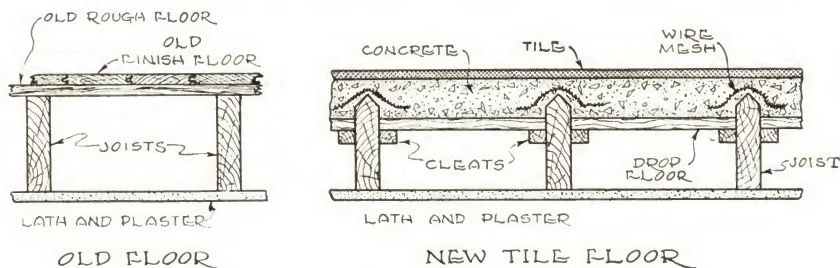


Fig. 203. Illustration Showing Changes Required for Tile Floor in a Bathroom

enameled, and the linoleum cemented directly to the roughened surface.

Pressed wood, and like products, can generally be nailed or cemented directly to the plaster.

Vitreous tile is the exception. When this material is to be used for wall surfaces, the old lath and plaster must be removed entirely. Metal lath is used in place of the old lath, and new mortar is applied, upon which the tiling is placed.

KITCHEN WALLS. Linoleum is a popular material for kitchen walls, and as stated for bathroom walls, it can be cemented directly to the old plaster.

STANDARD LENGTHS OF FRAMING LUMBER. In connection with the selection of materials, you should know and remember that certain framing materials, such as joists and studs, must be purchased in standard lengths which are generally in multiples of 2. For example, joists may be purchased 10, 12, 14, 16, or 18 feet long. Wherever

possible, new room sizes should be planned, so that the least waste in joists occurs.

Many other materials must be purchased in standard lengths, and waste can be avoided by designing room lengths, widths, and heights so as to use these standard lengths to advantage.

FIGURING AMOUNTS OF MATERIALS

Figuring amounts of new materials required must in many cases follow certain rules. For example, let us consider oak flooring.

To cover a certain space, figure the number of square feet, which means the width multiplied by the length; for instance, a room 12 feet wide by 15 feet long would contain $12' \times 15' = 180$ square feet. Add to the square feet of surface to be covered the following percentages:

Percentages to Add	Size of Lumber
50% for.....	$2\frac{5}{32}'' \times 1\frac{1}{2}''$
$37\frac{1}{2}\%$ for.....	$2\frac{5}{32}'' \times 2''$
$33\frac{1}{3}\%$ for.....	$2\frac{5}{32}'' \times 2\frac{1}{4}''$
$33\frac{1}{3}\%$ for.....	$\frac{3}{8}'' \times 1\frac{1}{2}''$
25% for.....	$\frac{3}{8}'' \times 2''$
$33\frac{1}{3}\%$ for.....	$\frac{1}{2}'' \times 1\frac{1}{2}''$
25% for.....	$\frac{1}{2}'' \times 2''$

These figures are based on flooring laid straight across the room. Where there are bay windows or other projections, allowance should be made for additional flooring. It is always well to order 5% additional flooring, to take care of errors in cutting and possible damage by careless handling.

The carpenter, lather, or other contractor will supply the percentages to be used in calculating the required amounts of other materials.

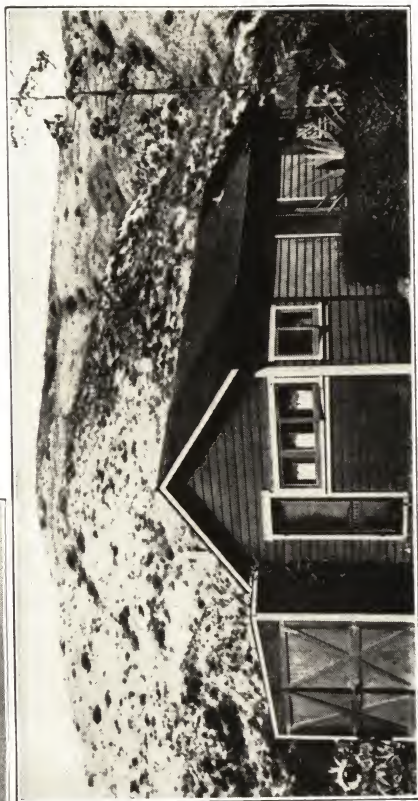
SPECIFICATIONS. It is obvious that before the specifications for a remodeling job can be written (see Chapter III), materials must be carefully considered. Careful consideration of materials may make the difference between successful remodeling and disappointment.

REFERENCE LITERATURE

You can obtain much reference literature relative to the selection of materials from the Departments of Agriculture and Interior at Washington, D. C. The U. S. Forest Products Laboratory at Madison, Wisconsin, also publishes some useful data.



LEFT, REMODELED HOME, WITH GARAGE CON-
VERTED INTO ATTRACTIVE UNIT OF HOUSE
Courtesy of U. S. Gypsum Company, Chicago, Ill.



RIGHT, HOUSE AND GARAGE AS THEY APPEARED
BEFORE REMODELING
Courtesy of U. S. Gypsum Company, Chicago, Ill.

CHAPTER XI

Bathrooms

IT IS not so many years since the plumbing we now consider indispensable was almost universally of the backyard variety. Of comfort there was none, especially in winter or in rainy weather; cleanliness was a casual matter of broom and pail; and crescents or stars cut into the doors provided the only decorative feature. In those days of not so long ago, bathing was usually confined to a tub beside the kitchen stove, while faces and hands were scrubbed at a "wash basin" kept in the kitchen.

As cities grew populous, however, municipal water supplies and a public means of sewage disposal were seen to be essential for the prevention of various epidemics; laws began to take cognizance of the matter of public health; and the first bathrooms made their appearance. The design of plumbing fixtures, quaint ancestors of our present-day models, began to claim the attention of a growing number of plumbing manufacturers, and slowly improvements were made.

Comparatively recent years have seen much greater advances, both in design and materials, so that at present the medium-priced fixtures are superior to the most costly ones manufactured only fifteen or twenty years ago.

However, many American homes are still without bathrooms, and a great number have bathrooms that are old-fashioned, inconvenient and inadequate, dilapidated in appearance, and difficult to keep in sanitary condition. There is widespread need, then, for remodeling and modernizing to provide new and better bathrooms. In this chapter, therefore, several important considerations are discussed and illustrated, and suggestions are given for remodeling and modernizing bathrooms.



MISCELLANEOUS CONSIDERATIONS. In addition to the general preliminary thinking outlined in preceding chapters, there are some special considerations which merit careful attention in connection with the remodeling or modernization of bathrooms. These concern certain general requirements, structural limitations, and mechanical features which you should understand before any actual planning is begun.

Codes. Most municipalities have laws pertaining to the design and installation of plumbing, found in published instructions commonly called *codes*. It is wise to secure copies of such codes and become thoroughly acquainted with their requirements.

Inspection. Nearly all cities and towns, as part of their building departments, have inspectors whose duty it is to examine new plumbing installations. To secure their approval, the plumbing installation must conform to the instructions given in the code.

Permits. In most cities it is necessary to obtain a permit before remodeling work is started. Do not overlook this important item.

Pipes Required. Building codes are almost uniform as to the various pipes required in a plumbing system. The following items cover the average piping requirements:

1. *Soil Stack.* Usually 4-inch cast-iron pipe, at least where a water closet is one of the fixtures. For sink or lavatory drainage only, 2- or 2½-inch wrought or galvanized iron soil stacks are sometimes permitted.

2. *Vent Pipes.* All fixtures must be vented. The size of vent pipes is always specified in codes.

3. *House Drain.* This is of tile or cast iron, and is that part of the sewer under the basement floor into which the soil stack and floor drain empty.

4. *Wastes.* These are galvanized or wrought-iron pipes which drain the various fixtures into the soil stack.

5. *Water Pipes.* All fixtures must be supplied with running water. Usually wrought-iron or copper pipes are used. Lead pipes are seldom used in modern plumbing. The size of the various water pipes depends on the number of fixtures served. Give careful attention to the selection of size.*

*The sizing of pipes, as well as the design of plumbing systems in general, is fully discussed in *How to Design and Install Plumbing*, published by the American Technical Society, Chicago.

Cross Connections. Infectious diseases sometimes arise from conditions found in seemingly safe plumbing installations. Water is easily polluted unless careful attention is given to proper installation.

The most common form of water contamination results from back-siphonage of organic materials into water supply pipes. For

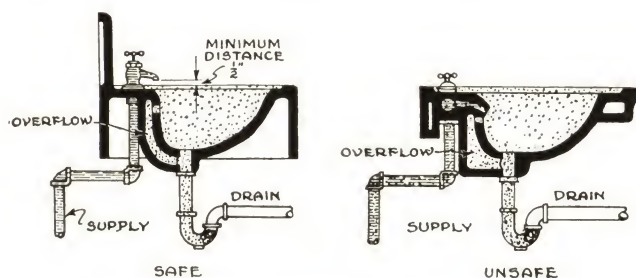


Fig. 204. Safe and Unsafe Installation of Lavatory Faucets

example, if a faucet is located so that part of it is below the level of water in a sink or lavatory, it constitutes a cross connection. Other examples may occur in water closets, bathtubs, and urinals.

Any reputable plumbing supply house will advise you how to avoid such cross connections.

Fig. 204 illustrates safe and unsafe installation of faucets for a lavatory.

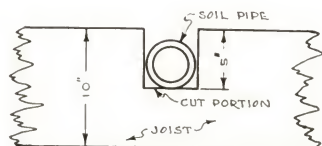


Fig. 205. Joist Showing Notch for Soil Pipe

Courtesy of Crane Company, Chicago, Illinois

Cutting Structural Members. Try to arrange your pipe system so that little cutting of joists and other structural members is necessary, since cutting joists and studs may seriously weaken framing. In remodeling work, this one consideration may dictate the position of the bathrooms.

Suppose, for example, that the position of a new water closet would necessitate running a 4-inch soil pipe across several joists. To do this would mean notching each joist about 5 inches. (See Fig. 205.)

The 5-inch notch, even in a 2x10 joist, leaves only 5 inches under the notch. A joist is only as strong as its weakest part; thus the 10-inch joist is in reality reduced to a 5-inch joist, as far as strength is concerned. When two or more such joists in floor framing are notched in this manner, a most serious weakening results.

In rare instances, the notching of joists cannot be avoided. In such cases the joists may be reinforced as shown in Fig. 206. The notch is shown at *D*. Pieces *A* and *B* are 2x4's spiked on the lower part, *C*, of the joist. Thus the notched joist has the combined strength of *A* plus *B* plus *C*.

Notching studs in bearing partitions also should be guarded against, since such partitions must carry the weight of the floors above.

Placing Bathrooms. *Convenience.* If you are planning a new bathroom, it would be more convenient if placed where it would serve

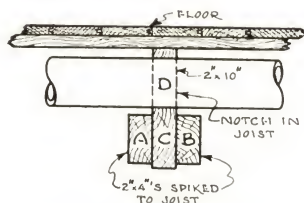


Fig. 206. How to Strengthen Notched Joists

Courtesy of Crane Company, Chicago, Illinois

as many rooms as possible at the least distance from them. This point is not always possible to carry out, but it should be kept in mind.

Economy. Placing the bathroom over the kitchen, so that the same soil stack may be used for both, results in economy in pipe and installation labor. If you are adding a second bathroom, it would be economical to place it so that the existing soil stack can be used. This would mean placing the two bathrooms so that they have one wall in common. Other arrangements for saving material and labor costs may present themselves as you consider your individual remodeling problem.

Accessories. Today a variety of accessories, such as grab rails, soap holders, towel racks, and like details add to the efficiency, safety, and modern effect in bathrooms. Grab rails along bathtubs may prevent dangerous falls, and are therefore important.

Roughing-in Drawings. Plumbing manufacturers will supply roughing-in drawings to the plumber who is installing their fixtures. These drawings show where supply pipes, waste pipes, and vents must be placed in order to connect with the fixtures when they have been set into place. These are vitally important, especially when we remember that the fixtures are set after the other work is finished.

Tub Hangers. When bathtubs are placed directly on the joists there may be a certain amount of settlement, eventually, which will cause cracks between the tub and the wall. To avoid this, you can use metal hangers. These are hung from the studs, and the tub is supported by them.

Fixture Dimensions. In planning the remodeling or modernization of bathrooms, you must consider the over-all sizes of the fixtures and the distances they will be from the wall and from each other; otherwise serious conflict may be discovered during or after installation.

Windows. For better bathroom ventilation, you may decide to make the window larger. Venetian blinds will assure privacy. If possible, avoid having the window near the tub.

Size of Bathrooms. Bathrooms need not be large. Small bathrooms are easier to keep clean, and considerably less costly. The smaller bathrooms use less wall, floor, and ceiling material, require shorter pipes, and are built with less labor cost. However, there should be ample room for each of the fixtures, and enough room between them for easy access. Make sure that the door opens without interfering with any fixture.

Heating. If a bathroom is so situated that it is difficult to heat from the central heating plant, a small electric heater can be installed in the wall, about $2\frac{1}{2}$ feet up from the floor.

Lighting. The use of either tubular or more conventional lighting fixtures on each side of a medicine cabinet over the lavatory makes excellent and ample lighting for a small bathroom.

Condensation. High humidity is often present in bathrooms. For this reason their ceilings should be enameled in order to avoid condensation, where insulation is not provided for that purpose. See Chapter IX.

Radiators. If radiators are required, they can be recessed in the wall, for improved appearance and to conserve floor space.

Materials. See Chapter X.

Minimum Requirements. The ideal situation in homes would be to have one bathroom for every bedroom, with water closets and lavatories at other convenient places. However, such practice is still too costly for the average home. The *minimum* requirements, which have been carefully studied, are outlined as follows:

Three or Four People in a House. There should be two water closets, two lavatories, one shower, and one tub. This could be accomplished by making one bathroom and a half bathroom, as explained in succeeding pages.

Two Floors with Bedrooms. If there are two floors on which there are bedrooms, each floor should have a complete bathroom.

Servants. In homes where servants are employed, there should be a complete bathroom for their exclusive use.

The blueprints in the back of the book show $3\frac{1}{2}$ bathrooms as the minimum requirement for the house there illustrated.

MODERN FIXTURES. The best way to study modern fixtures is by obtaining the catalogs of manufacturers, or by visiting display rooms and exhibits of model homes, such as are maintained in the larger cities. A few suggestions, however, are given in the following paragraphs:

Lavatories. Lavatories may be purchased in many colors and designs, some of the cabinet variety, some having legs, some wall hung. They come in many sizes, also. Their wide price range calls for careful planning. The visible pipes generally come with the fixture, but you should check this before planning your cost allowances. Lavatories should be selected after you have determined the size and shape of the bathroom. A careful study of the various styles of lavatories is recommended, so that you may obtain the best features your cost allowance will afford.

Bathtubs. Modern bathtubs of the conventional type are from $4\frac{1}{2}$ to 6 feet long. They are made to have either one, two, or three sides against a wall. They come in colors, also, and other features pertaining to them will be found in manufacturers' catalogs. Exposed piping is usually furnished with the tubs.

If possible, provide a removable wall panel through which the supply, waste, and vent pipes for the bathtub are accessible at any time. Such a panel would open on the outside of the bathroom wall.

It is possible, now, to purchase bathtubs which will fit into odd shaped areas. Some of these are illustrated in succeeding pages.

Water Closets. A great many types of water closets are manufactured. They differ in shape, width, height, color, quality, and action. Some have tanks, while others are flushed by a valve. Catalogs, which also give the space required for various installations and sizes, should be secured from manufacturers or their sales representatives. From these it is easy to select the style of fixture you want, and to make sure that it will fit into the space available for it.

Medicine Cabinets. Manufacturers put out various types of medicine cabinets, ready to install, plus mirrors. They, too, can be selected from manufacturers' catalogs. Usually they are installed in the wall over the lavatory.

Showers. *Stalls.* Shower stalls can be purchased, complete and ready to install, in various sizes and qualities. They are recommended because they are built especially to guard against leaks. Usually they require about 3 square feet of floor space.

Shower Heads. Shower heads for use in stalls or over tubs should be designed to allow mixing of hot and cold water, and to emit a good, well-proportioned stream. Thermostatic controls are recommended for shower heads, to prevent scalding.

Water Softeners. If you live in a section where the water is exceptionally hard, you may want to install water softening equipment. This equipment comes ready to hook up to the water lines, and it requires little and infrequent attention.

Water Heaters. Constant hot water is an essential convenience in modern bathrooms. During the summer it can be supplied by automatic gas or electric heaters, or where these are not available, by small coal or wood burning stoves designed for that purpose. During the winter months, when the furnace is in operation, coils connected with a storage tank can be installed in the firebox.

Miscellaneous. It is a good idea to install a shutoff valve in the pipe lines, near each fixture, so that faucet repairs can be made without shutting off the entire system. It is wise to buy first-class faucets, valves, and other fixtures, because they wear longer and are easier to maintain, in addition to their more attractive appearance. It is important to see that all fixtures and pipes are precisely installed, so as to be level and to provide proper slope for gravity drain.

MODERNIZING OLD BATHROOMS. It is a comparatively easy matter to plan the modernization of old bathrooms providing they are



Left, Fig. 207A. Typical Old-Style Bathroom

*Courtesy of Crane Company,
Chicago, Ill.*



Right, Fig. 207B. Bathroom of Fig. 207A After Remodeling

*Courtesy of Crane Company,
Chicago, Ill.*

amply large to begin with and thus easily converted to a new type.

What Can Be Done. Numerous items can be modernized in an old bathroom, as listed in the following:

1. Install modern tub.
2. Install modern lavatory.
3. Install modern water closet.
4. Install modern medicine cabinet.
5. Install new flooring.
6. Install new wall covering.
7. Enlarge window for better ventilation.
8. Change window location so it is not near tub.
9. Install shower head over tub.
10. Install new radiator.

Fig. 207A pictures a bathroom typical of those installed not many years ago. Notice the following undesirable features:

1. Old-style tub with legs
2. Old-style soap dishes on tub and over lavatory
3. Old-style faucets
4. Unsightly flooring
5. Unsightly and dirty cracks around base tile
6. Hard-to-clean area under bathtub
7. Old-style paper holder
8. Unsightly towel racks
9. Unsightly and hard-to-keep-clean wall treatment
10. Insufficient radiation
11. Unsightly pipes
12. Ugly lavatory
13. Cracks around lavatory
14. Unsightly and hard-to-reach medicine cabinet
15. Lack of lights around medicine cabinet
16. Old-style water closet
17. No shower equipment

In this undesirable bathroom, a wonderful change can be made simply by modernizing to correct the faults listed.

Fig. 207B shows the same bathroom after modernizing. If you will study and compare these two figures, you can see the remarkable improvement, point by point. The remodeled bathroom is efficient, easy to clean, and a pleasure to behold.

Attention is called, also, to Figs. 81A and 81B in Chapter IV.

Materials other than fixtures which are typically employed in bathroom modernization are discussed in Chapter X.

REMODELING LARGE BATHROOMS. Bathrooms in old houses were often made much larger than necessary. Where these exist, they can be remodeled to obtain all the benefits suggested for modernization, and at the same time they can be planned to serve the purpose of an additional bathroom—a happy solution for a growing family.

In Fig. 208, at *A*, study the plan and perspective of the large old-style bathroom on the left. In addition to the old-style fixtures the room is much larger than necessary. Now study the remodeled bathroom in *A*. This illustrates how, with two water closets, two lava-

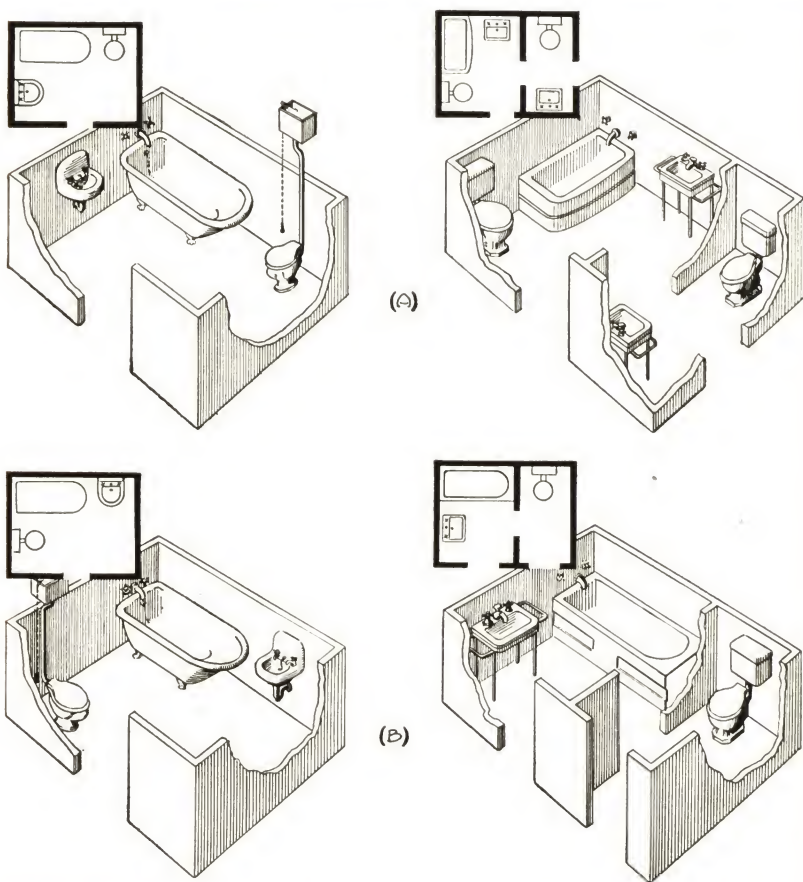


Fig. 208. Showing How Old-Style Large Bathrooms Can Be Remodeled to Serve Most of the Purposes of Two Modern Bathrooms

atories, and the tub, approximately the same space provides almost double efficiency and use.

At *B*, in Fig. 208, another double-purpose bathroom is shown, as it was developed from an old-style bathroom which was larger than was necessary or convenient.

The efficiency of any modern bathroom can be increased by installing two lavatories instead of one.

It is possible to plan double-purpose bathrooms even where the

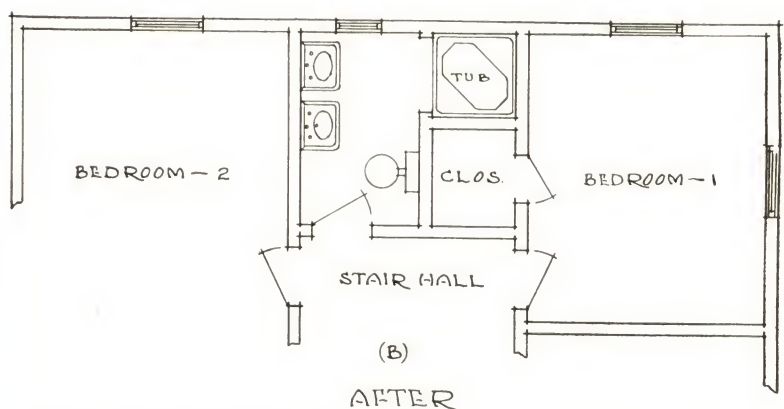
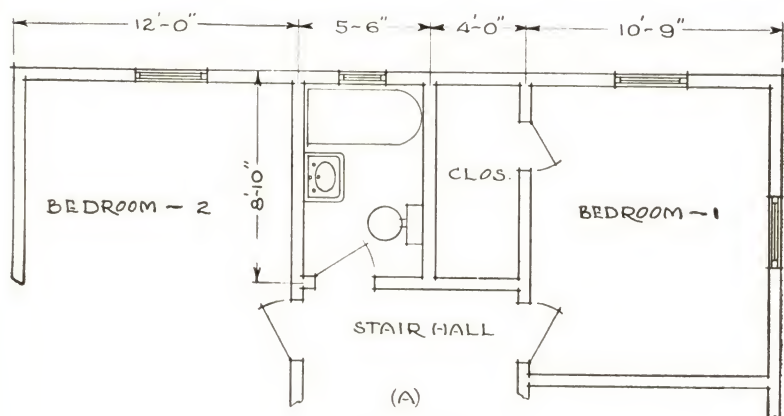


Fig. 209. Showing How Old Bathroom (A) Can Be Enlarged and Made More Efficient (B)

original room is not large, for sometimes enough additional space can be borrowed from adjoining closets or bedrooms.

Fig. 209 at A shows a typical example. Bedroom 1 has a large closet. The bathroom is small and contains only one lavatory.

Fig. 209, at B shows one possible remodeling plan whereby a part of the large closet for bedroom 1 is used for a new-type square bath-

tub, thus making room for two lavatories. Many such arrangements are possible in old houses, whose bedrooms, baths, and closets usually were large, in comparison with present-day planning.

HALF BATHROOMS. A half bathroom is one in which only a lavatory and water closet are installed. Present-day standards consider these half bathrooms a necessary convenience. They are most often located near kitchens or recreation rooms. The two fixtures can

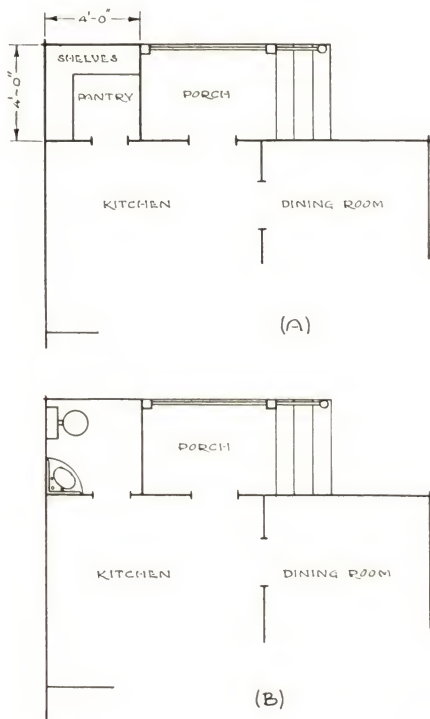


Fig. 210. How Half Bathroom Can Be Made From an Old Pantry

be installed in a surprisingly small area, one easily managed in remodeling.

In old houses pantries were considered a necessity, and some of them were of generous size. Our present-day kitchen equipment (see Chapter XII) has done away with the need of pantries. The areas formerly occupied by them may serve for half bathrooms. The lavatory may be small, and a small water closet may be selected also, so

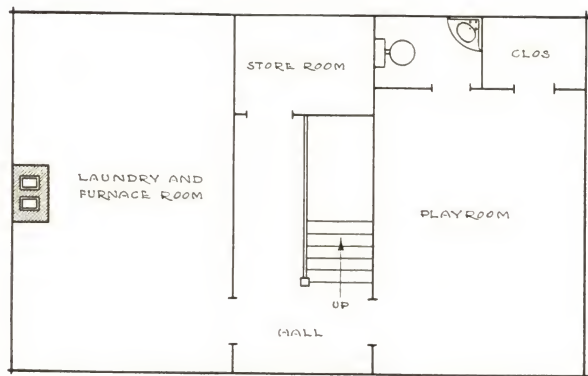


Fig. 211. How Space for Half Bathroom Can Be Provided in a Basement Playroom

that a space 4' by 4' is amply large. Fig. 210 illustrates a typical half bathroom remodeled from a pantry.

In cases where basements are being remodeled to provide a playroom, it is an easy matter to make space for a lavatory and water closet. Fig. 211 shows how a partition can be built across one end of a playroom to provide for a half bathroom and a storage closet.

Half bathrooms can also be built underneath stairs in spaces that could otherwise be utilized only for storage. An illustration is shown in Fig. 212. This same sort of arrangement could also have been resorted to in Fig. 211.

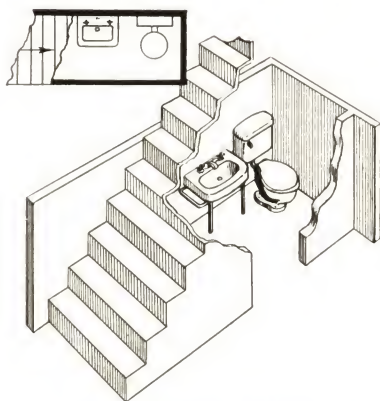


Fig. 212. How Space Under Stairs Can Be Used for a Half Bathroom

Space under stairways is not often available except in basements, since the stairs in an ordinary house are usually constructed one above the other. Sometimes it is possible to use the space under attic stairs, where they are not directly over the stairs coming up from the floor below.

POWDER ROOMS. Our modern desire for convenience has also created a demand for the powder room. These half bathrooms are usually located near the living room, and are designed for the convenience of guests during social functions. In them, special attention is usually given to lighting, mirrors, and decoration.

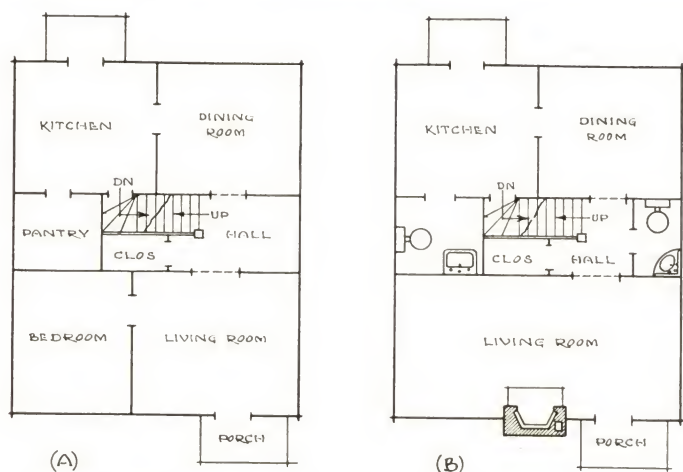


Fig. 213. Showing How Old Houses Can Be Remodeled to Include Modern Conveniences

Fig. 213, at A, shows the first floor of an old house built before bathrooms were common. Note the large hall and the pantry. At B, in Fig. 213, is an illustration of what can be done by way of remodeling. There are two half bathrooms, one for the kitchen and one for the living room. A more economical plan would have been to install the fixtures near the kitchen, and make them serve both kitchen and living room. Or the large hall could be remodeled into the typical powder room, as shown, leaving the pantry as it was.

ENTIRELY NEW BATHROOMS. There are many old houses, such as those shown in the floor plans of Figs. 73B and 79A in Chapter IV, which were designed and built prior to the time when bathrooms were

common. In an even greater number of houses, the bathroom facilities do not meet today's minimum requirements. In either case, any remodeling plans would surely include one or more new bathrooms.

The remodeling of floor plans, presented in Chapter XVI, in-

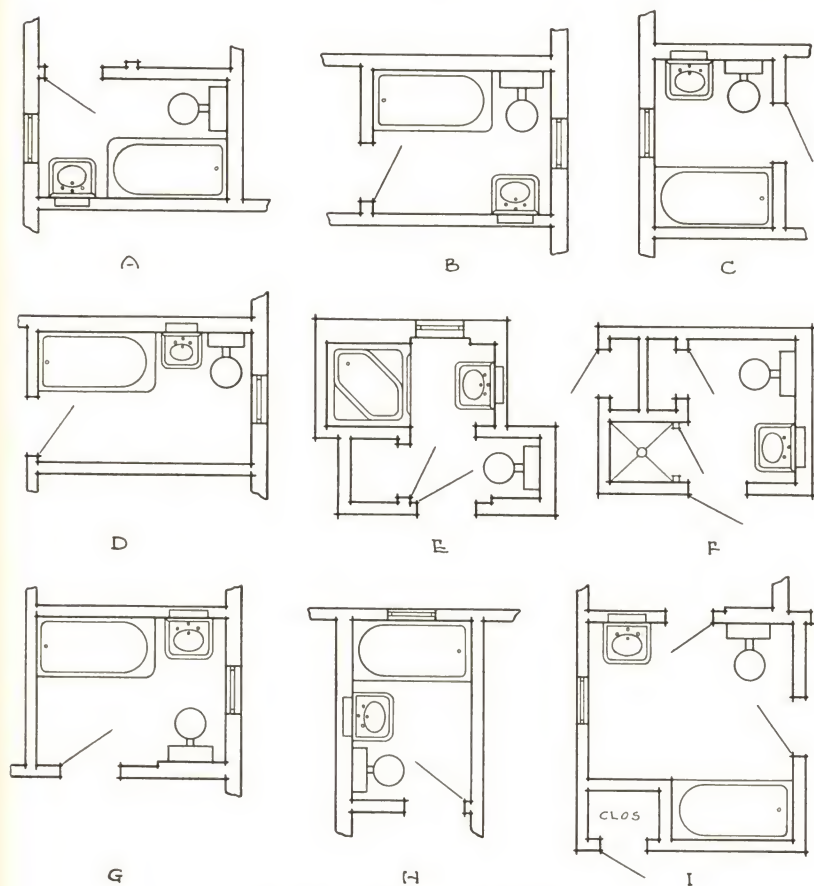


Fig. 214. Basic Types of Bathrooms

cludes explanations of the factors governing the size and shape of new bathrooms. For this present study, it is sufficient to consider how to arrange them once the size and shape have been decided.

Fig. 214 illustrates the more or less conventional or basic types of bathrooms designed for small areas. One of these types will usually be found to fit remodeling requirements, especially where only limited

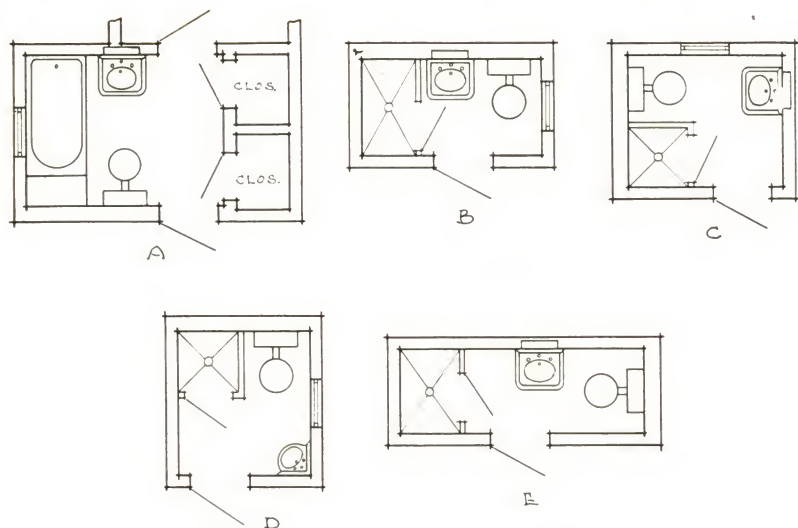


Fig. 215. Out-of-Ordinary Types of Bathrooms

space is available. The arrangements shown at A, B, C, D, G, H, and I are less costly to equip, while those shown at E and F, because of their irregular shape and the storage closets, are considerably more expensive. In remodeling, however, the irregularly shaped bathroom is frequently the best way of using available space.

Fig. 215 shows several bathrooms somewhat out of the ordinary as to shape, arrangement, and style of fixtures.

Fig. 216 shows duplex bathrooms of the type already described earlier in this chapter. They can be used in odd shaped areas, and serve a double purpose, since two people can use them at the same time with semiprivacy. They are recommended for large families in spite of their cost. They are cheaper than two separate complete bathrooms, and are often resorted to, in remodeling work.

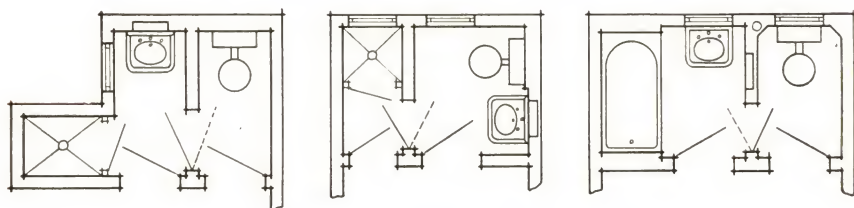


Fig. 216. Duplex or Double-Duty Types of Bathrooms

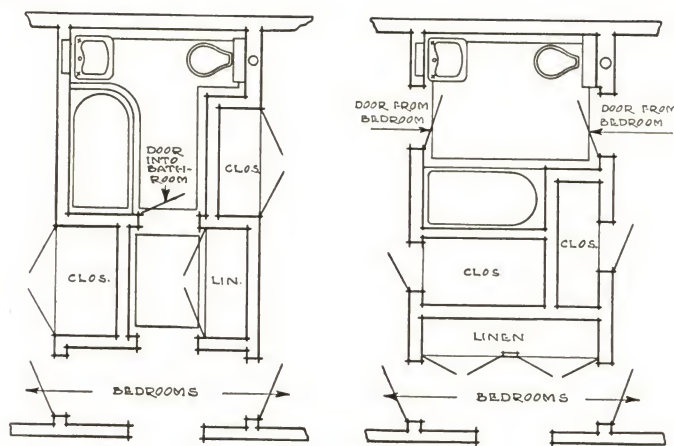


Fig. 217. Typical Bathroom Areas with Closets

Fig. 217 shows two rather elaborate bathrooms of the type designed to serve two bedrooms, directly. They are costly to build because of the intricate framing, the extensive surfaces, the closets, and the extra doors, but they work out splendidly where cost is not so essential a consideration.

Note Fig. 74B in Chapter IV. Here the remodeled floor plans were developed from Fig. 73B, in which no bathroom appears. The

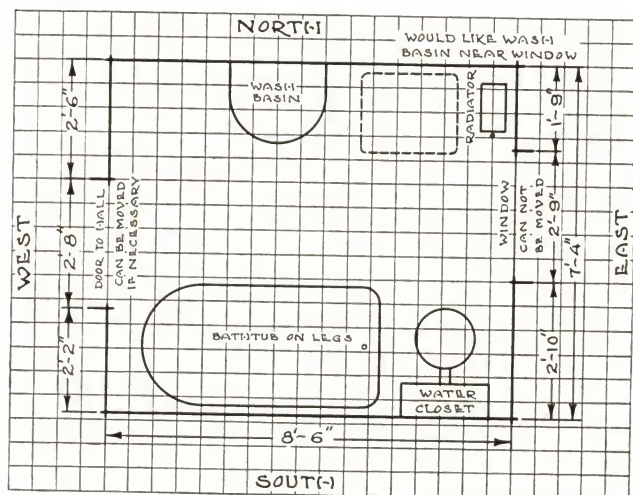


Fig. 218. Use of Graph Paper to Plan Bathroom Layouts in Remodeling

first-floor bathroom is a basic type like that shown at *H* in Fig. 214. The second-floor bathroom is a basic type similar to *I* in Fig. 214.

Note Figs. 85B and 86B in Chapter V. The remodeled bathroom is somewhat similar to *C* in Fig. 214, changed only slightly, to fit the existing conditions.

Refer to Figs. 79A and 79B in Chapter IV. Notice that the new bathroom is greatly similar to the type shown at *C* in Fig. 215.

Planning Bathrooms. Modernization and remodeling of old bathrooms and the planning of new ones is made easier by the use of graph paper, as indicated in Fig. 218. Think of each small square as one-half foot wide and one-half foot high, or in other words, four squares equal one square foot.

To lay out an old bathroom and design its remodeling, proceed exactly as explained for floor plans in Chapters VI, XV, and XVI. The fixtures can be drawn to scale by counting the small squares. This method will assure you that everything will fit as planned, and will give you a clear idea as to the space between and around the fixtures.

For new bathrooms, placing the required fixtures in this way will help determine the necessary size of the room.

In laying out the remodeling floor plans, as described in Chapter XVI, you may have to make certain changes which will also necessitate changing the bathrooms, so that you will have to plan them all over again. However, this is one of the hardest problems in planning remodeling—to make all the rooms fit together without sacrificing more than necessary of the requirements for the individual rooms. It is best, therefore, to plan the bathrooms as individual rooms, and to revise them if necessary in order to fit them into the general floor plan. The time and effort you thus spend in planning will be generously rewarded by the results.

CHAPTER XII

Remodeling Kitchens

ASIDE from bathrooms, there is nothing that so clearly dates a house, and nothing that so determines its convenience, attractiveness, and future market value as the design and equipment of the kitchen.

Only a few years ago the typical kitchen consisted of a gas stove or range, a sink, several chairs, and a table—all scattered about the room wherever they happened to fit the wall spaces. The icebox was just as likely to be out on the porch or in an entryway as in the kitchen proper. Cooking utensils were often stored in a pantry or closet, far from where they were used. Preparing and serving meals meant literally hundreds of unnecessary steps, and it is no wonder that under such circumstances women considered “kitchen work” so tiring and unpleasant.

A typical kitchen of today contains many new types of fixtures, along with the traditional ones which have undergone revolutionary improvement; all of these are grouped so that every function can be carried on with the fewest possible steps and with a maximum of efficiency.

The modern kitchen is truly a beautiful and cheerful room, easy to keep clean, and is planned to reduce labor to a minimum and to do away with drudgery entirely.

Remodeling a kitchen is a fascinating project that can be realized at moderate cost. This chapter proposes to outline the items relating to kitchens which require careful consideration, to call your attention to modern kitchen equipment, and to show you how to go about transforming an old-fashioned kitchen into a cheerful and efficient workroom for the modern housewife.



MISCELLANEOUS CONSIDERATIONS

Before attempting any actual planning of kitchen remodeling, you must become acquainted with certain essentials which you will have to consider if your remodeling is to be successful.

MODERN KITCHENS ARE SMALLER. The efficiency demanded in modern kitchens has pared them to much smaller sizes than ever before. However, they must not be reduced to the point where they will be uncomfortable to work in. Size must also be governed by the

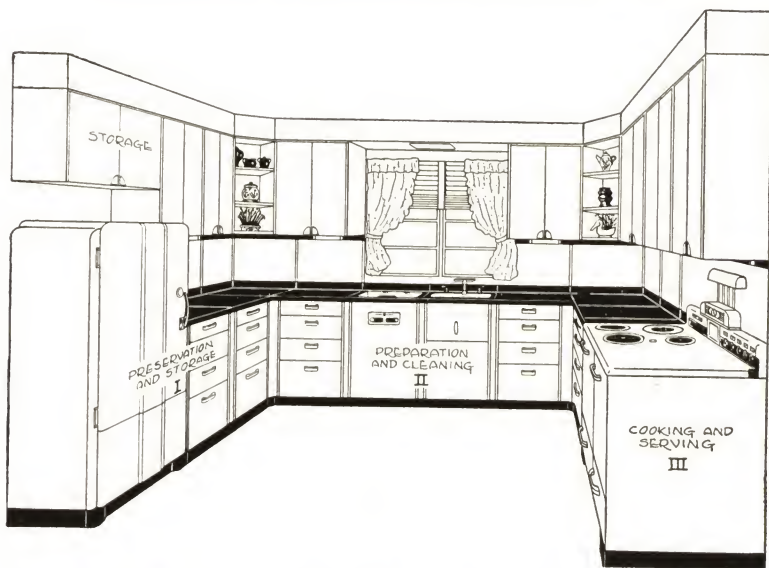


Fig. 219. The Three Work Centers in a Modern Kitchen. Note Numbers for Each Center
Courtesy of U.S. Gypsum Company, Chicago, Ill.

dimensions and amounts of fixtures required, the size of the family, and the entertaining that is customarily done. There should be at least three- or five-foot clearance between fixtures on opposite sides of the room. In rectangular shaped kitchens the most economical dimensions for families of medium size are 8x10, 8x12, or 10x14 feet. For large families dimensions of 12x16 or 14x16 feet may be required.

WORK CENTERS. The planning of a kitchen may well follow, to some extent, production line principles, used in factories as a means of promoting efficiency and eliminating waste motion. In a factory the raw materials come in at one door, convenient to unloading points,

and go through the factory. They come out another door as finished products. In like manner food deliveries should come in through the kitchen entry door, go through an efficient processing, and go out through the dining room door as ready-to-serve meals.

Arranging a kitchen to provide for efficiency requires that three work centers be provided and thoroughly equipped. The centers are illustrated in Fig. 219 and outlined as follows.

Preservation and Storage—Center I. This center should contain:

- a) Refrigeration facilities for the storage of perishable foods
- b) Low cabinets for storage of canned foods, dry foods, and utensils
- c) Wall cabinets for supplies and equipment used in food preparation—bowls, dishes, and general storage

d) Counters for mixing and carrying on kitchen work

Preparation and Cleaning—Center II. This center should contain:

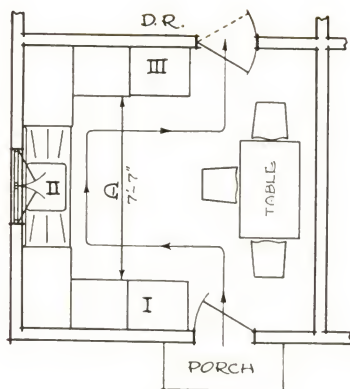
- a) Wall cabinets for dishes and glassware
- b) Sink for dish washing and cleaning of vegetables
- c) Low cabinets for cleaning equipment and supplies, silver and utensils, garbage containers, and towels and towel driers
- d) Drainboards and counters, for stacking and draining dishes, and work areas

Cooking and Serving—Center III. This center should contain:

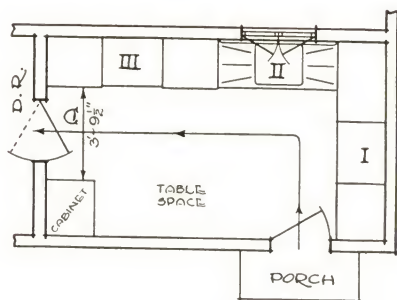
- a) Range for cooking and baking
- b) Counters near dining room door, for serving
- c) Wall cabinets for storage of tea, coffee, salt, pepper, sugar, flour, cereals, cutlery, and frying pans
- d) Low cabinets for serving dishes, coffee makers, toasters, and other utensils

With the three centers arranged as shown in Fig. 219, incoming food can be stored, prepared, cooked, and served; soiled dishes can be brought back to the serving counter, taken to the cleaning center, and finally be put away in their proper places—all with maximum efficiency and with very few steps. Any modern kitchen, regardless of its shape, can be planned with like efficiency in mind.

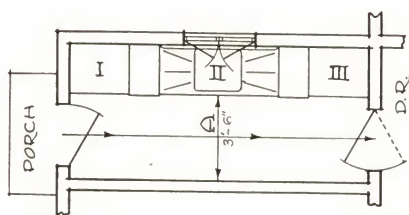
It is often desirable to provide space and furnishings for eating informal meals in the kitchen, or space may be required for other activities. Notice that such provisions are included in some of the succeeding illustrations.



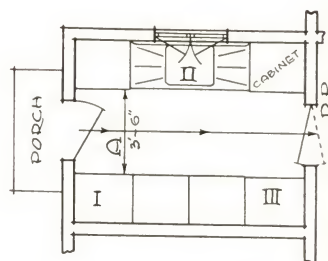
U TYPE



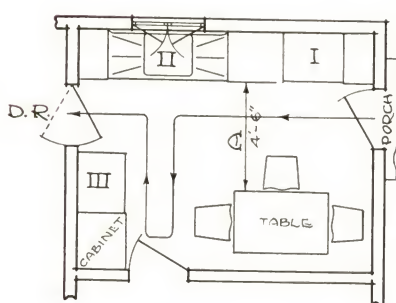
L TYPE



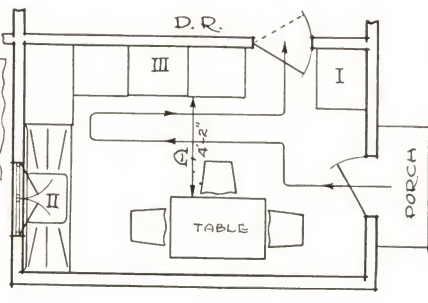
ONE-WALL TYPE



TWO-WALL TYPE



BROKEN-L TYPE



BROKEN-U TYPE

Fig. 220. Basic Types of Kitchens

TYPES OF KITCHENS. Kitchens, of course, cannot be entirely separate or segregated rooms. They are parts of houses, and often concessions must be made in their shape, to satisfy the needs for other rooms. This is an important point in remodeling, because here the shape of the kitchen is even more likely to depend upon the specifications for other parts of the house. (This will become clear as you study Chapter XVI.)



Fig. 221. Typical U-Type Kitchen

Courtesy of Curtis Companies, Inc., Clinton, Iowa

Because of these conditions, kitchens may be rectangular, square, or long and narrow, and they may be broken at inconvenient places by doors. The most common shapes and types are described and illustrated in the following pages. These basic types will suggest ideas for planning kitchens of any shape.

U Type. The U type kitchen is shown at the upper left in Fig. 220. It is considered the best of the six basic types because it is rectangular and is the most compact. Roman numerals *I*, *II*, and *III* indicate the work centers as shown in Fig. 219. Note that in the U

kitchen the work centers can be arranged perfectly as regards the entry and dining room doors and that the storage, preparation, and cooking and serving centers can conform to an ideal arrangement. Less walking is required, everything is within easy reach, and yet there is room for a table which can be used for informal meals or as a desk. Fig. 221 shows a photograph of a kitchen patterned after the **U** principle. You can appreciate the work-saving possibilities and the efficiency of this layout by visualizing the small number of steps between work centers.

L Type. Next to the **U** type the **L** type is the most efficient and popular kitchen. (See Fig. 220.) It provides space for a table and does not require much walking or reaching. There is also space for an additional cabinet in the corner which can be used as a storage place for mops, a carpet sweeper, brooms, furniture polish, dust cloths, and similar items.

One-Wall Type. In remodeling work it often happens that kitchens must be rather long and narrow. This occurs when half bathrooms or closets are made at the expense of some of the former kitchen area. In such cases the one-wall kitchen works out nicely, especially when the doors are at the ends of the room, as shown in Fig. 220. This type of kitchen is not as efficient as the **U** or **L** types but can be made far superior to the old-fashioned kitchen. The fact that there is no space for table or chairs makes for some inconvenience, as all meals must be served in an adjoining nook or dining room.

Two-Wall Type. Where rectangular kitchen areas are not wide enough for **U** or **L** types but too wide for a one-wall type, or where the entry and dining room doors must be at the ends of the room, the two-wall or corridor-type kitchen works out fairly well. This necessitates more walking and reaching but provides space for additional cabinets which can be used for general storage purposes. This type of kitchen lacks the charm and coziness of the **U** type but is the only solution in many remodeling jobs. See Fig. 220.

Broken-L Type. In many instances perfect **L** kitchens are impossible because of the necessity for three doors due to the arrangement of other parts of floor plans. However, Centers *I* and *II*, with but slight inconvenience for *III*, can be planned in a pleasing manner. As shown in Fig. 220, there is room for a table or desk and an additional cabinet.

Broken-U Type. As shown in Fig. 220, the doors in a kitchen of the broken-U type are close together. This complicates the planning and takes away some of the coziness and efficiency. However, there is room for a table or desk, and by proper planning of the three work centers a desirable kitchen layout can be obtained. Fig. 80 in Chapter IV shows a photograph of a kitchen patterned after the broken-U type.

Variations. In many instances existing conditions cause a remodeled kitchen to vary considerably from the basic types already discussed. Such variations, while not ideal, can still be made into modern and efficient arrangements.

Some typical variations are shown in other parts of the book as indicated in the following:

Fig. 74B, Plate 1, Chapter IV. Here a variation of the U type has been created. The refrigerator center is a little inconvenient; otherwise the kitchen is well-planned.

Fig. 79B, Plate 1, Chapter IV. This kitchen might be called a variation of the broken-U type. The arrangement requires more steps than would be ideal but is nevertheless desirable.

Fig. 86B, Chapter V. This kitchen is the least desirable among those illustrated, because the arrangement does not make for efficiency and because the many short wall surfaces are hard to use.

TRAFFIC THROUGH KITCHENS. As far as possible kitchens should be planned to avoid a great deal of traffic through them. The kitchen in Fig. 74B, in Chapter IV, violates this rule, since all traffic to and from the garage must pass through it. The kitchen in Fig. 79B of Chapter IV, also violates the rule. In remodeling work, because of partition, door, window, and other arrangements, the rule about traffic cannot often be followed. An entryway to the basement (along the side of the kitchen or between a portion of the kitchen wall and a wall of another room) is one good way of avoiding excess traffic, but this is not always possible, either.

CLEAR SPACE IN KITCHENS. It is highly desirable to plan the kitchen so that there is ample clear space for easy movement of people and furniture. In Fig. 220 the dimension, A, indicates the aisles recommended in each type of kitchen.

PLACING RANGES. Ranges, no matter what fuel they utilize, should be spaced at least 6 inches away from walls and from other

fixtures or units. This lessens the fire hazard and makes possible better flow of waste heat away from the other units.

BUYING UNITS PIECEMEAL. You need not meet the total cost of remodeling your kitchen at one time. It can be planned completely; then one or two units can be purchased and installed as your financial budget will allow. Each unit, as you acquire it, should be installed in accordance with your complete plan. One advantage of the ready-made units is that they adapt themselves rather well to this plan of installment remodeling.

MODERN KITCHEN EQUIPMENT

You are advised to study equipment carefully before buying. Examination of catalogs, visits to dealers' showrooms and to model homes, and talks with friends who have already modernized their kitchens will help you obtain the best equipment for the money. The process familiarly known as "shopping around" can be followed here to good advantage. Look at as much equipment as possible, then select what seems best under the particular circumstances.

SINKS. Sinks come in many sizes and qualities. They may be purchased as part of a cabinet unit, or they may be bought separately and installed with cabinets also bought separately. In the latter case, however, be careful; see that they fit together properly. Sink cabinets are obtainable in wood or in metal construction. Study them in manufacturers' catalogs and literature, or by visits to dealers' display rooms and to exhibits of model homes.

It is wise to purchase a *good* sink, even if its cost is high. Acid-resistant finish is a good investment. So are double drain boards. Sinks with electric dish washers and like equipment are desirable if your budget can stand the strain.

RANGES. Gas stoves have been improved so radically that no kitchen is modern if it contains an old one. Be sure that the stove you select has all the automatic features, as well as good insulation and an ample oven. A flat table top is preferable, and the stove should be flush with the floor for ease in cleaning.

Electric ranges are popular in localities where electrical energy is not too expensive. The new types are rapid in cooking, easy to keep clean, and automatic in many details. For localities where neither gas nor electricity is available, some oil stoves give excellent performance.

It is wise to buy a *good* range, no matter what the kind.

REFRIGERATORS. Refrigerators are now obtainable for operation with electricity, gas, or oil. Thus no locality is without some means of refrigeration, and this equipment is one of the first requirements of any modern kitchen. Refrigerator sizes, capacities, heights, and widths vary greatly and should be checked prior to planning.

CABINETS. A study of Figs. 77B and 80, in Chapter IV, and of Figs. 219, 221, 223, and 227 in this chapter, show that a considerable share of kitchen planning has to do with the selection and placing of cabinets of various styles and sizes.

Types of Cabinets. In Fig. 219, where the three work centers are illustrated, several typical cabinets are shown. Cabinets known as *base units* are those that rest on the floor, and whose tops form work counters. You can buy this type of cabinet in pan units, tray units, bread drawer, or drawer units, and also in units for storage of utensils, electric appliances, or food. Pan units usually have one or more drawers, with a larger space divided by one or more wire shelves. Drawer units ordinarily have three to six drawers of varying widths and depths.

Cabinets known as *wall units* are placed above the work counters along the walls. Usually these contain two or three shelves.

Small cabinets over refrigerators sometimes are desirable. These are called *over-units* or *over refrigerator units*. (Note that for over-units in this chapter, a manufacturer's symbol, *R30*, is used instead of the *P* or *Q*, in Fig. 223.)

Sink fronts, which leave areas for installation of sink and drainboards, are available also. These units may contain shelves, drawers, and garbage receptacles.

Other cabinets designed for kitchens include broom closets, corner units, linen-storage units, metal bins, cutlery trays, ironing board units, and spice units.

There are many manufacturers of kitchen cabinets. Some specialize in wood cabinets, others make them entirely of metal. They come already painted or otherwise finished, or you can buy them unfinished. It is a good idea to buy unfinished cabinets if you have a special color scheme in mind.

Cabinets usually are ordered by catalog number, and are delivered complete and ready to install.

Sizes of Cabinets. Base units, wall units, and over-units range from 12 to 44 or more inches wide (across the front). Sink fronts vary in size to fit standard sink sizes. Broom closets may vary from 18 to 24 inches in width.

The depth of the cabinets, or the distance which they extend out from the walls, is generally about 24 inches for base units and broom closets, and 14 inches for wall and over-units.



Fig. 222A. Typical Old-Style Kitchen
Courtesy of Crane Company, Chicago, Ill.

The height of base and sink-front units is generally 32 inches. Wall units are about 36 inches high. Over-units are about 16 inches high for the most part. The average height for a broom closet is 64 inches.

Sizes vary slightly in the different makes, so it is always wise to secure dimensional information from the manufacturer or dealer, after you have decided where to buy.

In selecting cabinets, make sure of their material and size, whether they are finished or unfinished, what quality hardware is

furnished with them, and how many drawers and shelves they contain. Metal linings for certain drawers might also be considered.

You will find illustrations and full information concerning cabinets in manufacturers' catalogs which are free for the asking.

MISCELLANEOUS. Electric clocks, telephone extensions, excellent lighting, ventilating fans, radiator covers, garbage receptacles, no-fuse circuit breakers, electric mixers, sharpeners, and grinders are



Fig. 222B. Kitchen of Fig. 222A, After Remodeling
Courtesy of Crane Company, Chicago, Ill.

among the host of gadgets and appliances which contribute to efficiency and to appearance in the modern kitchen.

WHAT CAN BE ACCOMPLISHED BY REMODELING? The results you can obtain, even by fairly economical remodeling, are extraordinary. The difference between an old and a modern kitchen is as great as between a 1910 model and a present-day automobile. The following paragraphs present a typical comparison.

Study Fig. 222A. Notice in it the items listed in the following summary. These, bear in mind, are typical of old kitchens:

1. The sink is old-fashioned, ugly, inconveniently placed, hard to keep clean near the walls, too small, and too high. It is probably badly stained, also.

2. The table, besides being shabby, is too small, too far below the level of the sink, and too far away from the range.

3. The range is old-fashioned, too small, lacks modern appliances and finish, and cleaning under and around it is difficult.

4. The garbage-can corner is untidy, appears dirty, and certainly is not in keeping with modern standards of cleanliness where food is being prepared.

5. The floor is worn and uninteresting.

6. The pipes are an eyesore.

7. The walls are dirty; and no one could keep them looking nice.

8. The windows are too wide to leave open, and not well proportioned.

9. There is no trace of efficiency; hundreds of steps must be taken unnecessarily.

10. The room is completely cheerless.

Such a kitchen is a dreary place in which to confine a housewife for hours out of each day.

Now look at Fig. 222B. Notice the change which has been brought about by the modern range, sink, and cabinets, together with new windows and new wall and floor treatment.

Figs. 77A and 77B, in Chapter IV should also be studied for like contrasts.

HOW TO PLAN THE REMODELING OF KITCHENS

If you are planning the remodeling of a kitchen, you are likely to be confronted with one of four basic conditions:

1. A large old kitchen which is being reduced in size to provide more convenience and efficiency, and to make room for a half bathroom, or a breakfast nook.

2. An old kitchen which is being modernized, but not changed in shape or size.

3. An entirely new kitchen, with no restrictions as to size or shape.

4. A new kitchen whose size and shape are largely determined by requirements of other rooms in the floor plan.

No matter which of these conditions you encounter, certain fundamental planning procedures are necessary. These procedures will be explained in separate steps, and their principles will be applied to the assumed example.

STEP 1. Cabinet Selection. One of the first things the average housewife thinks of, in relation to remodeling her kitchen, is the installation of kitchen cabinets. This is logical thinking, too, because the cabinets must be decided upon before the shape of the kitchen can be planned or the work centers designed.

The first step in any kitchen remodeling, therefore, is the *tentative* selection of the types and sizes of cabinets. As previously explained, types and sizes can be chosen from manufacturers' catalogs.

In this selection, the three work centers should be kept in mind, in order to provide the base and wall units necessary for efficiency. Each center should be considered separately—you should tentatively select units for each and note the lengths and depths of the units. As a general rule, each center should contain units somewhat as previously described, and which we outline here:

<i>Center I</i>	<i>Center II</i>	<i>Center III</i>
<i>Base</i>	<i>Base</i>	<i>Base</i>
1. Refrigerator	1. Corner units	1. Range
2. Bread-drawer unit	2. Drawer units	2. Pan units
3. Pan units	3. Sink units	3. Drawer units
<i>Wall</i>	4. Pan units	
1. Over-units	5. Tray units	
2. Wall units	<i>Wall</i>	
	1. Wall units	
	2. Round shelves	

When the units for each of these centers are tentatively selected, the next suggested procedure is the making of templets (patterns).

STEP 2. Templets. Once the make, type, and dimensions of the cabinets have been determined, draw plan views of them on stiff paper. Make these views accurately to scale, using either the $\frac{1}{4}'' = 1'0''$ or $\frac{1}{2}'' = 1'0''$ scale. Fig. 223 shows a typical group of such plan views which were drawn to the $\frac{1}{4}'' = 1'0''$ scale. The dimensions are shown to help you visualize how the templets are drawn. For exam-

ple, the templet at *A* represents a unit 28" long and $24\frac{1}{2}$ " deep (distance it extends out from the wall). Label each templet so that it can be identified as representing a certain unit.

STEP 3. Determine Basic Condition. The basic condition is determined by a study of the house you plan to remodel, and through the thinking that you have done previous to this stage of the work. (See Chapter IV.) Whatever that condition is, your planning must be based upon it. For example, if the old kitchen is too large and a part of it is to be added to the dining room or made into a half bathroom, give some preliminary thought to this procedure and to the resulting

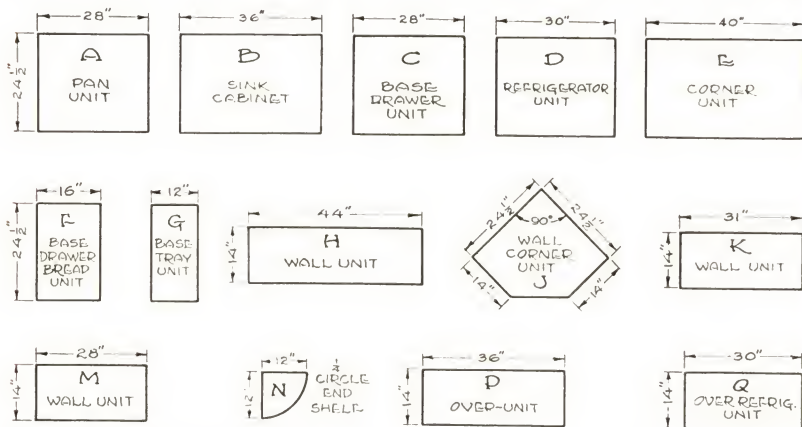


Fig. 223. Templets for Typical Kitchen Base and Wall Cabinets Drawn to $\frac{1}{4}$ " = 1'0" Scale. (Letters A, B, etc., are Explained in Accompanying Text Material)

size of the kitchen. At the same time you must decide upon the type of kitchen—whether it is to be **U** or **L** shaped, or otherwise. These two factors of size and type will depend somewhat on individual taste, as well as on the location of doors leading to other rooms or to the outside, on the location of windows, and on the general floor plan.

STEP 4. Space for Units. Next determine the total space required for the base cabinets comprising the various centers. For example, if Center *I* contains the base units listed under *Cabinet Selection*, the width of all three units can be added together. In like manner find the total or combined widths of all base units planned for Centers *II* and *III*. These figures, plus the type desired, practically determine the size and shape of your kitchen.

STEP 5. Actual Remodeling Work. Now the old kitchen area can be reduced in size, or adapted without change of size to the modernization plan, or the new kitchen can be planned, depending on the basic condition encountered. This must be done keeping Step 4 in mind and at the same time remembering not to interfere with any of the requirements in relation to other rooms, such as doors.

STEP 6. Draw Scaled Plan. Next draw a carefully scaled plan of the remodeled or new kitchen. Show walls, windows, and doors by the proper symbols.

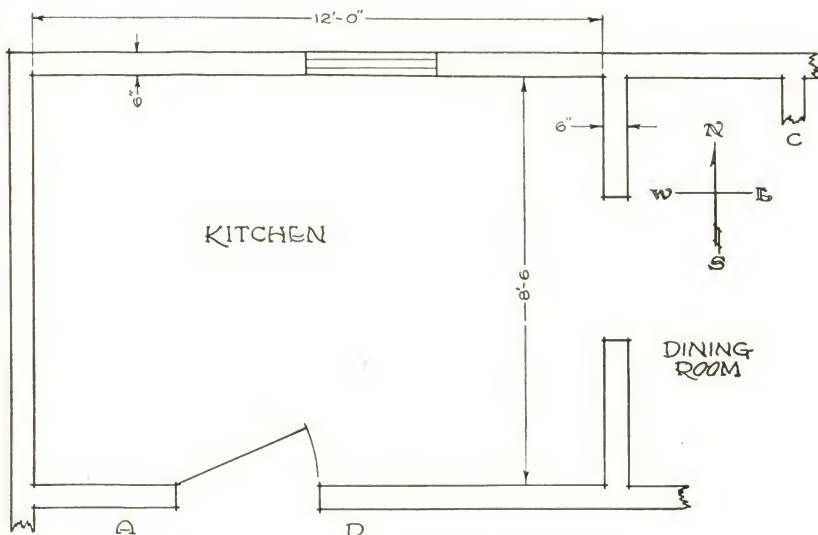


Fig. 224. Kitchen After Having Been Reduced in Size

STEP 7. Use Templates. The templates, representing the various cabinet units selected, are now put to good use. Place them on the scaled plan in about the positions which the actual units will occupy in the completed kitchen. This serves as a definite check on the relation of the size and shape of the kitchen to the work centers and the units chosen for them.

It is seldom that the first trial will work out satisfactorily. Generally the shape or size of the room, and the size and number of units, conflict in one way or another. Then you must "juggle" the units around, choosing larger or smaller sizes, or different styles; or else try to change the shape of the kitchen to meet the needs. The process

sometimes requires a great deal of patience, compromises here and there, and changes that were not anticipated. However if you will make a game of it, something like a jig-saw puzzle, you will enjoy fitting the pieces together, and will be more than pleased with the final results.

ILLUSTRATIVE EXAMPLE

Let us take for our illustrative example a large old kitchen, and assume that the owner wants to use part of the kitchen area to enlarge the dining room, and another part for an entryway and a half bathroom. The resulting small kitchen is to be completely modernized.

Study Fig. 224. Imagine that the east wall of the kitchen was at *C* and that the south wall was 5'0" south of its indicated position in Fig. 224. The window may be changed or remain as it is.

Solution. **STEP 1.** The units previously listed under Step 1 were the ones selected. Such units are typical of the average modern kitchen and provide satisfactorily for the three work centers.

STEP 2. Let us assume that the templates shown in Fig. 223 are the plan representations of the kinds and sizes of units chosen.

STEP 3. The basic condition is a large old kitchen which is to be reduced in size to make room for an enlarged dining room, an entry, and a half bathroom, and to make possible the planning of a modern efficient kitchen.

From a study (in Fig. 224) of the necessary doors, to the entryway, *A*, and bathroom, *D* (rooms not shown but letters indicate their approximate position) and also to the dining room, we find that an **L** type kitchen is the only possible choice.

STEP 4. The combined lengths of the units tentatively selected in Step 1 added, by work centers, for the base, are as follows: (See Fig. 223.)

<i>Center I</i>	<i>Center II</i>	<i>Center III</i>
<i>Base</i>	<i>Base</i>	<i>Base</i>
1. Refrigerator—30"	1. Corner unit—40"	1. Range—48"
2. Bread-drawer unit—16"	2. Drawer unit—28"	2. Pan unit—28"
3. Pan unit—28"	3. Sink unit—36"	3. Drawer unit— 28"
	4. Tray unit—12"	
	5. Pan unit—28"	

The totals are:

Center *I*, $30'' + 16'' + 28'' = 6'2''$ (plus $24''$ for corner unit = $8'2''$)

Center *II*, $40'' + 28'' + 36'' + 12'' + 28'' = 12'0''$

Center *III*, $48'' + 28'' + 28'' = 8'8''$

STEP 5. The remodeling of this kitchen is simply a reduction in its size. The south wall is moved toward the north so that the width of the kitchen becomes $8'6''$ as shown in Fig. 224. The east wall is moved westward so that the kitchen becomes $12'0''$ long. It can be seen that Center *I* will fit along the west wall, that Center *II* will fit

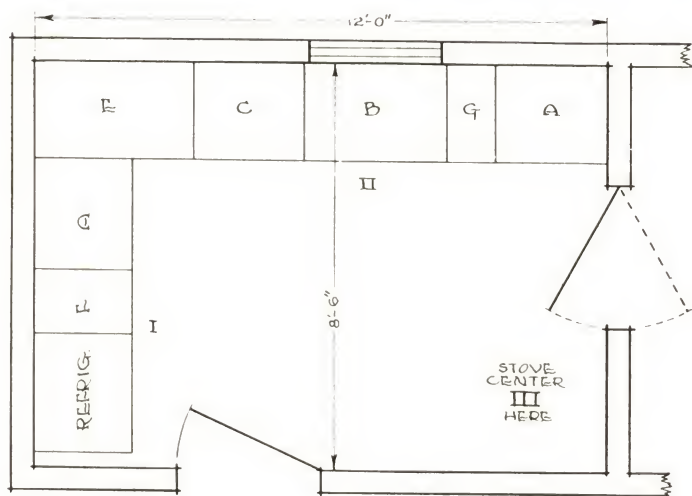


Fig. 225. Base Units Planned

along the north wall, but that Center *III* is too long to fit along the south or east walls because of the doors. Therefore, we may have to make some changes. At this stage only Center *III* seems to conflict with any other requirement, such as doors.

STEP 6. Refer to Fig. 225. This shows a scaled drawing of the remodeled kitchen plus all the necessary symbols.

STEP 7. The base templates representing Center *II* (A, B, C, E, and G in Fig. 223) can now be placed on the scaled drawing, Fig. 225, and tried in various locations. The sink unit, B, is put under the window. The corner unit, E, is put in the corner. The pan unit, A, is

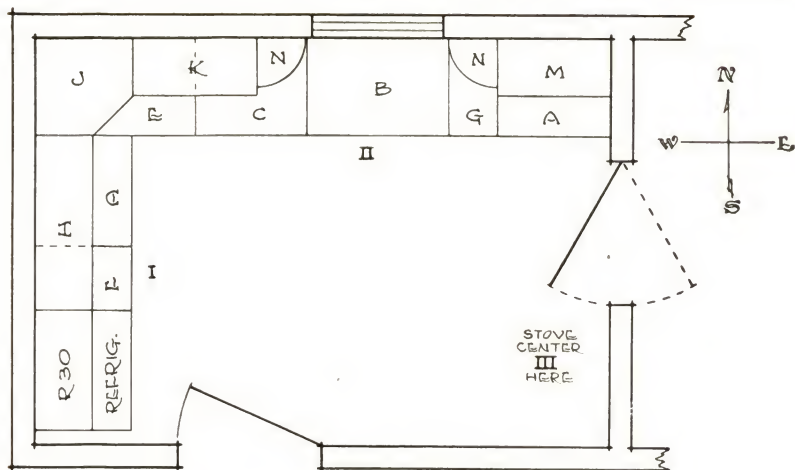


Fig. 226. Base and Wall Units Planned

put at the east wall. Then the drawer unit, *C*, and the tray unit, *G*, fit in as shown in the figure.

The templets for Center *I* can now be placed. The refrigerator is placed first, as shown, near the door from the entry. Next the bread-drawer unit, *F*, is placed and finally the pan unit, *A*.

Since the units desired for Center *III* will be too long to fit, it is a good idea to omit the pan and drawer units and place the range in

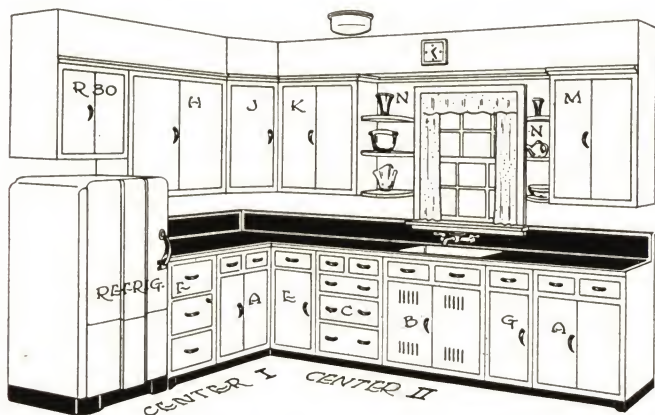


Fig. 227. Perspective View of Centers *I* and *II* for Kitchen Planned in Illustrative Example, Relative to Figs. 224 through 226. Letters Shown Correspond with Letters in Figs. 223, 225, and 226

Courtesy of Curtis Companies, Inc., Clinton, Iowa

the southeast corner. That will leave room for a table or desk, also, along the south wall.

The wall templets for Centers *I* and *II* are placed in the same manner and are illustrated along with the base units in Fig. 226. The letters such as *M*, *N*, etc., refer to the templets shown in Fig. 223.

The cabinets are now completely planned and checked. Therefore the plan stands correct and the cabinets may be ordered.

A radiator or register can be placed along the south wall.

The materials for walls, ceiling, and floor would be selected as outlined in Chapter X.

Fig. 227 shows a perspective view of Centers *I* and *II* of the kitchen we have just designed. The letters on the various units correspond with letters shown in Figs. 223, 225, and 226.



AMERICAN COLONIAL PERIOD FIREPLACE AND MANTEL WITH
FACINGS AND HEARTH OF MARBLE

Courtesy of Curtis Companies, Incorporated, Manufacturers of Curtis Woodwork, Clinton, Iowa

CHAPTER XIII

Heating and Air Conditioning

DURING the past several years, endless numbers of new and improved materials, equipment, appliances, furniture, and fixtures, designed to enhance the comfort and charm of houses, have been manufactured, invented, and developed. Because of these, average homes built today can be far superior in a dozen ways to the best of homes built only fifteen or twenty years ago. Because of these, also, the remodeling and modernization of old houses is all the more gratifying and worth while.

Of all these improvements perhaps none contributes more to comfort, health, and enjoyment than our modern heating and air-conditioning equipment.

It is not so many years, since the great majority of houses depended upon stoves for warmth and comfort in winter. A few of the more extravagant boasted an old-style gravity furnace. The heat was uneven, insufficient, and dry. The furnace was kept going only by hard labor, and a great deal of dirt and dust was involved in the process.

For the warm and sultry months there was no comfort at all. Houses were hot during the day, and often even hotter at night when the heat which had been stored in the structural bulk during the day was released.

Today, through relatively inexpensive remodeling and modernization, houses can be made comfortable for both winter and summer; and manual labor, dust and dirt, and other inconveniences of bygone days can be eliminated.

It is the purpose of this chapter to define modern heating and air conditioning, describe typical apparatus, explain how a



typical heating system is laid out and designed, and in general to acquaint you with this modern improvement and its benefits.

WHAT IS AIR CONDITIONING? During the last few years the term *Air Conditioning* has been widely publicized, and in some cases very loosely used. You should be careful, therefore, to understand its real meaning before considering the purchase of equipment for modernizing old heating systems.

The several ways in which the term may be correctly used are explained in the following paragraphs:

Winter Air Conditioning. A winter air-conditioning system should perform the following functions:

Warm the Air. The warming can be accomplished in several ways, explained in succeeding pages.

Humidify the Air. All warmed air should be humidified to the point where it will be healthful and comfortable. Excess humidity should be avoided, as it is likely to cause damage to decoration and to structural members.

Filter the Air. All air leaving the furnace should be filtered by one of several devices made for that purpose. The object is to remove as much dirt and dust from the air as possible. If the removal of bacteria, odors, and pollen is also desired, additional apparatus is necessary.

Circulate the Air. For the sake of comfort and health the warmed air should be circulated by means of a blower. This forcing of the air permits recirculation up to 100 per cent. Recirculation is a considerable economy.

Summer Air Conditioning. A summer air-conditioning system should perform the following functions:

Cool the Air. Air should be cooled by the use of coils around which the air passes. In connection with these cooling coils either a refrigerant or cold water must be used. A refrigeration machine is necessary unless a source of *cold* water, such as a deep well, is at hand.

Dehumidify the Air. Dehumidification is the process of removing some of the moisture from the air. This can only be accomplished by cooling coils, or other apparatus made especially for this purpose. True summer air conditioning is not achieved unless there is efficient dehumidification.

Filter the Air. This is the same for summer as for winter air conditioning.

Circulate the Air. The cooled and dehumidified air must be circulated and recirculated by a blower, the same as for winter air conditioning.

Full Air Conditioning. A full air-conditioning system is one which combines the functions of both winter and summer air conditioning.

Automatic Controls. In any air-conditioning system the use of automatic controls is absolutely necessary. Thermostats and humidostats, for example, control the temperature and the humidity. Without such automatic controls, the air could not possibly be kept in unvarying condition.

Note. Any system for heating and cooling that does not perform the functions explained in the foregoing is not an air-conditioning system in the true sense of the term and should not be referred to as such. A heating system which does not conform to these true air-conditioning functions should be referred to simply as a heating system, either gravity or mechanical (blower), plus any other functions which it performs.

As explained in Chapter IX, air conditioning is not feasible from the standpoint of economy or results, unless insulation is installed.

MODERN HEATING SYSTEMS

The types of heating systems most often used in remodeling old houses are the gravity, mechanical, dual, hot-water, and vapor systems. Occasionally other types are employed, such as steam, but not frequently enough to be included in this discussion. An understanding of some of the principles of these systems will aid you in selecting the type best fitted to the particular conditions with which you are confronted.

GRAVITY SYSTEMS. A gravity furnace system consists, in general, of a furnace or heater, pipes for distributing the warmed air to the various rooms, pipes for the return of cold air to the furnace, and warm- and cold-air registers.

In operation a gravity furnace uses coal, gas, or oil as fuel. The burning fuel generates heat which, by gravity circulation, goes to the various rooms of a house.

The air supply to the furnace may be taken entirely from the inside of the building or it may be a combination of inside and outside air. If the air is entirely from the inside, the system is described as recirculating, whereas if part of the air comes from the outside, the system is said to be 50, 60, or 80 per cent recirculating, as the case may be. Ordinarily the recirculating system is more economical, because the air returned to the furnace from inside is not much below the required room temperature, and thus uses less fuel for reheating. Furthermore, the ordinary house is not so tightly constructed but what enough "fresh" air can enter by infiltration, as explained in Chapter IX.

Furnaces. Most gravity furnaces are constructed of cast iron or steel, and are encased in a housing of sheet metal or brick. The cold

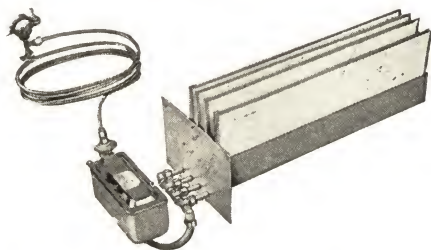


Fig. 228. Humidifier for Use in Gravity or Mechanical Heating Systems

Courtesy of Malt-O-Mist, Chicago, Ill.

(return) air enters the bottom of the casing, passes through and over parts of the furnace where it is warmed, and enters the distribution pipes near the top of the furnace.

Distribution Pipes. The round pipes generally visible in the basement are called *leaders*. For best results these should not be over 8 or 10 feet long. They slope from the furnace to the point where they join the pipes, called *stacks*, which go up through the partitions. Wherever possible, warm-air stacks should be located in interior partitions. If they must be in outside walls they require insulating. Cold-air stacks are usually placed in outside walls.

Registers. All registers, both for warm and for cold air, should be in a vertical position in the wall, rather than horizontal, or flush with the floor. Warm-air registers should be in interior partitions, and cold-air registers should be in outside walls.

(Instructions for the simple design procedure required for gravity systems are available from the University of Illinois Experimental Station, at Urbana, Illinois.)

Humidity. Appliances to raise the humidity of the warm air in a gravity system can be installed in the bonnets (tops) of furnaces. Such a device is illustrated in Fig. 228.

Disadvantages of Gravity Systems. Because this system depends upon gravity for the circulation of the air, there are some disadvantages, which may be offset by its low cost, in many cases. Some of these disadvantages are:

1. The furnace must be centrally located, in order to avoid long leaders. This necessarily places it in a position where it is likely to interfere with other uses of the basement.

2. The leaders and return-air pipes take up a good deal of space, and this also interferes with use of the basement for other purposes. Of course, in very small and compact houses, sometimes only one return-air pipe is necessary, in which case not so much pipe room is required.

3. Because circulation in this type of heating system depends on the tendency of warm air to rise and cold air to drop (principle of gravity) it is sometimes difficult to heat certain rooms in the houses which are not so small and compact. This is especially true in houses whose over-all dimensions are long, or where ells and other irregularities exist.

4. The air cannot be satisfactorily cleaned (filtered) as filters are likely to offer more resistance than the gravity circulation can overcome.

5. In order properly to humidify warm air, a great deal of it must pass the humidifying appliance per hour, at an appreciable velocity. Gravity systems do not have much velocity.

6. Gravity systems do not function to the best advantage in houses exposed to strong winds.

MECHANICAL SYSTEMS. The mechanical system is so designated because a blower forces the circulation of air. The term *forced air* is also used sometimes to designate these mechanical systems.

Furnaces. These furnaces are made of cast iron or steel, and are encased in sheet metal housings. The blowers, filters, and humidifiers are within the same housing. The whole apparatus requires

little space, and can be painted or otherwise neatly finished. The types made for the use of gas or oil as fuel require little floor space. See Fig. 229.

Distribution Pipes. In mechanical systems the distribution pipes are called ducts. They are rectangular in shape, and can be run along the ceiling where they do not interfere with other uses of the basement, or whatever room the furnace occupies. The depth of the ducts can be controlled so that they will fit into odd spaces between studs, or over or under girders. Warm-air ducts should always

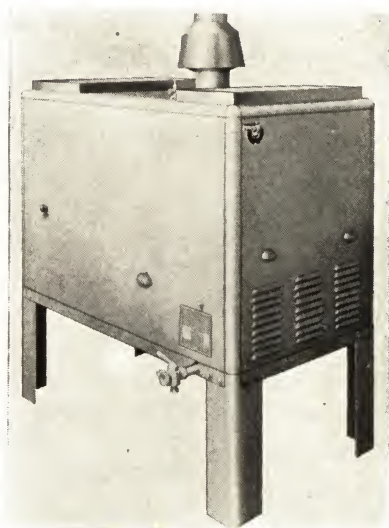


Fig. 229. Typical Gas-Fired Mechanical
Furnace

Courtesy of The Trane Company, LaCrosse, Wis.

be in interior partitions. If they must be placed in outside walls, heavy insulation is necessary. Cold-air ducts may be put in outside walls. Fig. 230 shows a typical distribution system.

Grilles. The grilles, which perform the same function as registers in a gravity system, are smaller than old-style registers, and usually more decorative. They can be placed in the baseboard, or in the walls six feet up from the floor, except for the cold-air return grilles, which must always be in the baseboard. Warm-air grilles should be put in interior partitions wherever possible, and cold-air grilles in outer walls.

Humidity. Ordinarily mechanical furnaces come already equipped with some humidifying apparatus. In cases where they do not, the manufacturer will usually recommend a suitable type of humidifier, such as shown in Fig. 228.

Filters. Like humidifying apparatus, filters usually are built into mechanical furnaces by the manufacturers. There are many varieties of filters, some of which occasionally have to be either cleaned or replaced.

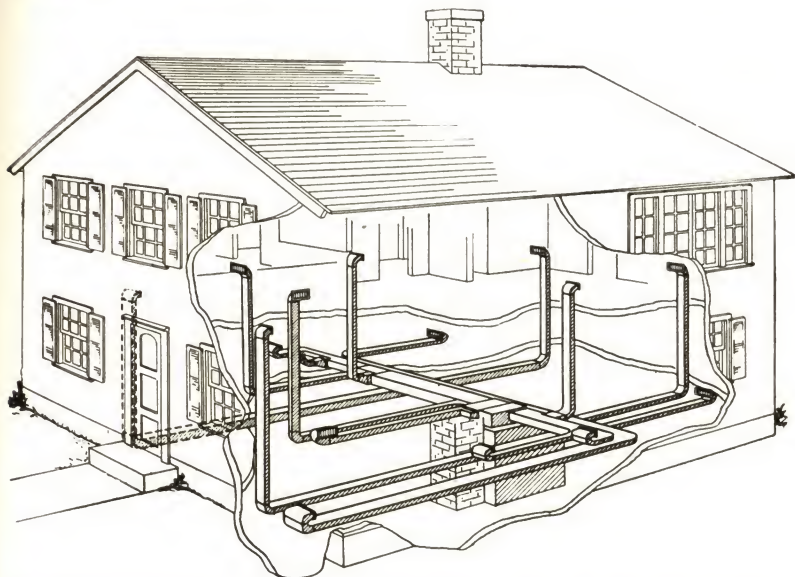


Fig. 230. Typical Layout of Distribution Ducts for a Mechanical and Air-Conditioning System

Air Distribution. The warmed air is forced to circulate as already explained, usually by means of a centrifugal fan, commonly called a blower. The blower forces the air through the warming chamber, through the filters, past or through the humidifying chamber and thence into the supply ducts and to the various rooms. The force creates a pressure in the rooms, and this, together with gravity, forces the cold air to return to the furnace.

Mechanical furnaces may recirculate air entirely, or they may use a certain percentage of "fresh" air, as explained in the discussion of gravity systems. In both gravity and mechanical systems, no air is returned to the furnace from kitchens or bathrooms.

Fuels. Coal, oil, or gas may be used as fuel. Since the kind of fuel used has a decided bearing on the design of the furnace, however, the fuel to be used should be decided upon before the furnace is selected. Some of the differences in design for the three fuels are:

1. Coal
 - a) Bituminous—large combustion space with good flue travel
 - b) Hard coal or coke—large combustion space and liberal heating surfaces
2. Oil
 - a) Good sized combustion space
 - b) Long fire travel
3. Gas
 - a) Large heating surface
 - b) Good contact between flame and heating surface

Bonnet. The bonnet (top of furnace) should be as high as the ceiling will allow, to form a chamber of good size. This will equalize air pressure and temperature, and will make for better distribution through the ducts.

Advantages of Mechanical Systems. There are numerous advantages of mechanical systems which should be taken into consideration. Some of these are outlined here:

1. The furnace can be located anywhere in the basement. This makes it possible to use the basement area to good advantage.
2. The furnace also can be located on the first floor in houses where there are no basements and none are planned.
3. The ducts can run along the ceiling and need not be deep, allowing ample head room and not interfering with use of the basement area.
4. There is provision for the efficient cleaning and humidifying of the air.
5. Positive air circulation can be maintained, so that all parts of each room can be warmed fully and evenly, without drafts.
6. The systems are manufactured now so that units for summer cooling can be added at any time. The fan then circulates cooled air.
7. The fan makes possible the use of cool night air for greater comfort during warm weather.
8. The systems are automatically controlled to fulfill every requirement for health and comfort.

9. In general, mechanical systems meet the requirements of true air-conditioning systems if, as previously explained, they are equipped to perform all the functions included under that term.

HOT-WATER SYSTEMS. Hot-water systems employ water heated to 150°F. or higher as a means of supplying heat to the various rooms of a house. Briefly, such a system consists of a boiler, distribution pipes, and radiators, with accessory equipment. The water is heated

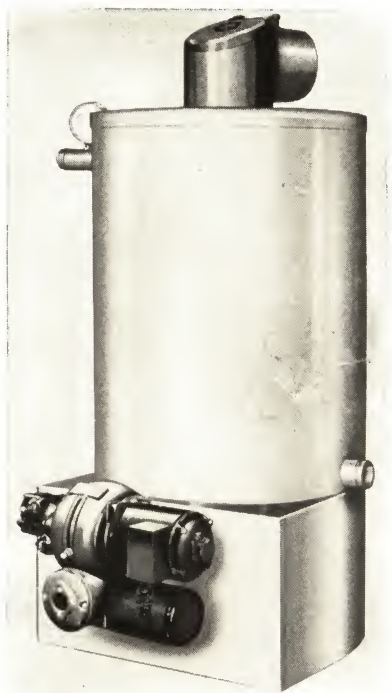


Fig. 231. Typical Hot-Water Boiler
Courtesy of The Trane Company, LaCrosse, Wis.

by coal, oil, or gas as fuel, then circulated through radiators which give out its heat.

Boiler. Fig. 231 illustrates a typical boiler.

Radiators. Radiators are of two general types. One stands in the room, while the other is recessed in the walls. The latter is commonly known as a recessed convector type. Ordinarily the recessed types are made of copper. See Fig. 232. They have the ob-

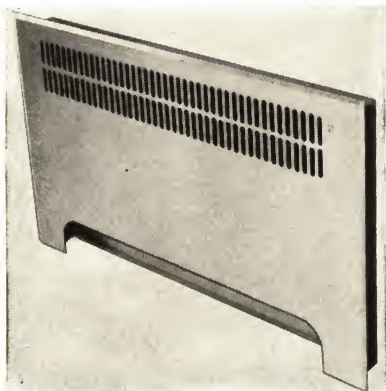


Fig. 232. Recessed Convactor-Type Hot-Water Radiator

Courtesy of The Trane Company, LaCrosse, Wis.

vious advantage of being out of sight and requiring no floor space. In connection with convectors it is often wise to use an automatic vent, as illustrated in Fig. 233.

Humidity. Humidity can be provided by using the type of humidifying apparatus shown in Fig. 234. This apparatus is used in connection with convectors. For ordinary radiators, the appliance shown in Fig. 235 may be used.

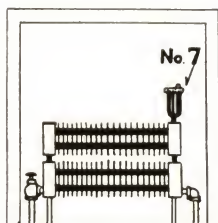


Fig. 233. Automatic Vent for Convactor-Type Hot-Water Radiators

Courtesy of Maid-O-Mist, Chicago, Ill.

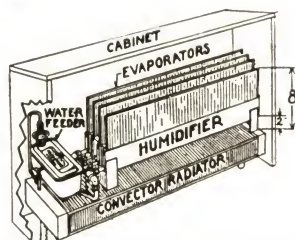


Fig. 234. Humidifier for Use with Hot-Water Recessed Convactor

Courtesy of Maid-O-Mist, Chicago, Ill.

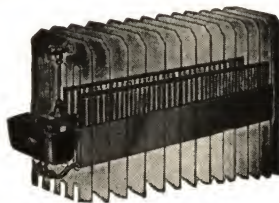


Fig. 235. Humidifier for Use with Ordinary Radiators

Piping Systems. The older hot-water heating systems usually have a two-pipe distribution system. In this case there is a supply and return pipe for each radiator or convector. An improved one-pipe system is shown in Fig. 236. This system costs considerably less, and is less expensive to install.

Circulation. The older two-pipe systems generally depend on gravity for circulation. The new one-pipe systems have a motor-driven pump which creates positive circulation, a distinct advantage.

(For design procedure relative to hot-water piping and for radiator or convector selection, reference can be made to the American

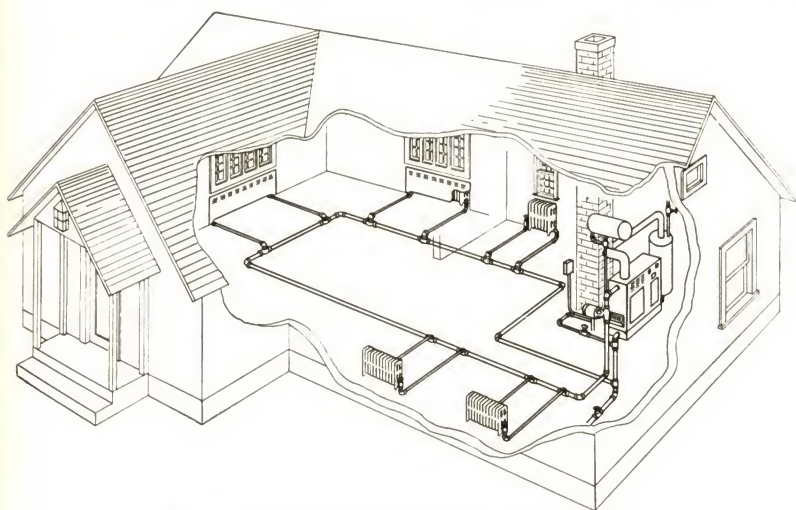


Fig. 236. Typical One-Pipe Hot-Water Heating System

Society of Heating and Ventilating Engineers' Guide. See also *Heating and Ventilating*, American Technical Society, Chicago.)

DUAL SYSTEMS. For houses heated by steam, hot-water, or vapor systems, apparatus is available by which the benefits of air conditioning can be obtained in varying degrees.

Note Fig. 237. This figure shows a dual system of heating and air conditioning where the air can be humidified, filtered, and circulated to selected rooms in the house. Ordinarily living rooms, dining rooms, and in some instances bedrooms, are thus air conditioned. Other rooms are heated only.

In Fig. 237, the radiators or convectors at *E* have steam or

hot-water pipes and ducts running to them. The ducts are shown at *B*, *C*, *F*, and *G*. The duct at *D* is an intake for fresh air. The air conditioning apparatus is at *A*.

In this system the filtered and humidified air is forced, by a fan in *A*, through the ducts to the radiators or convectors at *E*. As the conditioned air passes the radiators or coils in the convectors it is heated.

An air-conditioning unit often used with steam or hot-water

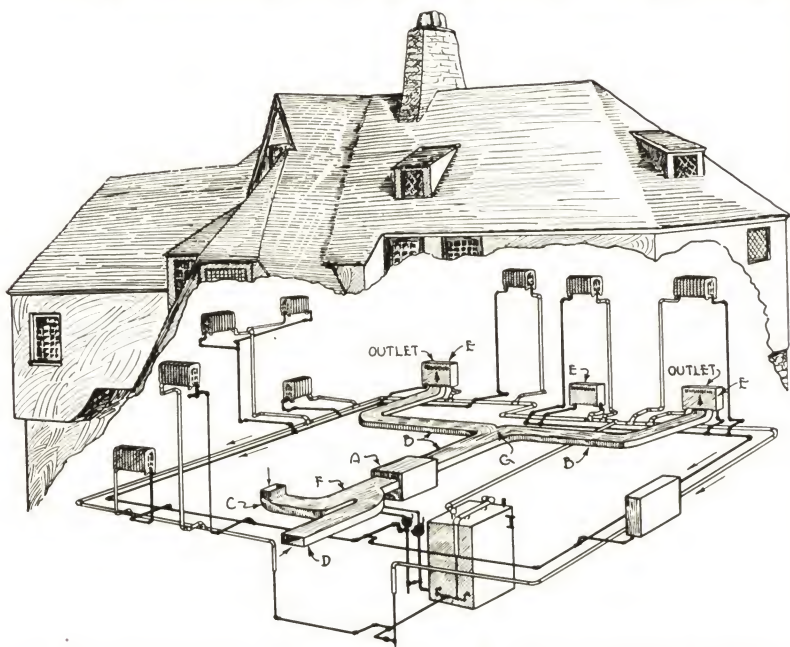


Fig. 237. Air-Conditioning System in Conjunction with Steam or Hot-Water Heating
Courtesy of Hoffman Specialty Company, Chicago, Ill.

systems is shown in Fig. 238. This unit is suspended from the basement ceiling and connected by ducts to various rooms as required, somewhat as illustrated in Fig. 237. The unit contains filters, a humidifier, heating coils, and a blower. The heating coils are connected to the boiler. Thus air from this unit is heated, filtered, circulated, and humidified.

One decided advantage of the dual systems is that kitchens, bathrooms, garages, and bedrooms which need not be air conditioned can still be heated as required.

VAPOR SYSTEMS. A vapor system is a two-pipe steam system which has many desirable additional features.

In a vapor system the steam circulates at a very low pressure—only a few ounces above atmosphere. In an ordinary steam system the air (which collects in all radiators) is forced out through an air valve. The removal of this air requires considerable steam pressure. In a vapor system the air is removed in such a way that only a few ounces of pressure are required.

In vapor systems the steam enters radiators at the top and flows downward as it condenses. At the bottom of the radiator there is a trap, which allows water and air, but not steam, to flow into a pipe which returns to the boiler.

The advantages of a vapor system are as follows:

1. The heat output of each radiator or convector can be controlled by the valve between the supply pipe and the radiator or convector.
2. The radiators or convectors become warm quicker than in ordinary steam systems.
3. There is no air vent and thus no possibility of water, steam, or odor escaping into the areas in which the radiators are located.
4. The low pressure tends to allow more economical operation of the system.
5. The heating is somewhat more even.

The types of air-conditioning apparatus described for hot water may be employed with vapor systems, also.

FUELS AND STOKING. Coal. For furnaces and boilers using either soft or hard coal as fuel, many kinds of automatic stokers are obtainable. These stokers feed coal into the fireboxes automatically whenever more heat is desired. Ordinarily they are controlled by temperature instruments.

Some stokers have to be filled by hand at long intervals. Others take the coal directly from the coal bin. In some the clinkers and ashes must be removed by shovel (soft coal) whereas in others (hard coal) the ashes are removed by a part of the stoker assembly.

Oil. Oil must be transferred into a furnace or boiler by the feeding apparatus of any one of several kinds of oil burners. These burners operate automatically. Tanks for oil storage are necessary.

Gas. Gas, like oil, requires one or another kind of burner. These

burners also are automatic. No storage tanks are required, since this fuel would not be economical to use in a district without piped gas.

Advantages of oil and gas as fuels are that the heaters generally require less floor space, and in most cases automatic controls can be used in a more positive manner.

AUTOMATIC CONTROLS. Gravity. In a simple gravity furnace system, automatic controls are limited in their possible action, usually to opening and closing drafts and dampers. If automatic firing is used, controls are necessary to start and stop stokers or burners.



Fig. 238. Typical Apparatus Used for Dual Systems
in Steam and Hot-Water Heating
Courtesy of The Trane Company, LaCrosse, Wis.

Mechanical. For mechanical systems the American Society of Heating and Ventilating Engineers lists the essential requirements of automatic controls as follows:

1. To keep the fire burning when using solid fuel regardless of the weather
2. To avoid excessive bonnet temperatures with resultant radiant heat losses into the basement
3. To avoid the overheating of certain rooms through gravity action during off periods of blower operation
4. To have a sufficient supply of heat available at all times to avoid lag when the room thermostat calls for heat
5. To prevent cold-air delivery when heat supply is insufficient
6. To avoid heat loss through the chimney by keeping stack temperatures low
7. To provide quick response to the thermostat, with protection against overrun

8. To provide for humidity control
9. To provide a means of controlling summer cooling
10. To protect against fire hazards

(All kinds of automatic controls for hot water, steam, and vapor systems can be studied in manufacturers' manuals. Also see *Furnaces and Unit Heaters*, American Technical Society, Chicago.)

COOLING METHODS. There are many methods of summer cooling and dehumidifying, ranging from costly systems to inexpensive natural cooling. A few of these are discussed briefly in the following paragraphs.

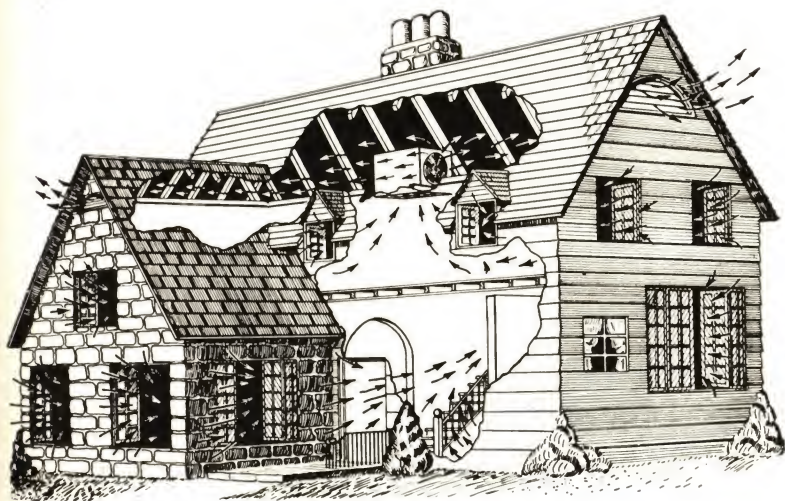


Fig. 239. Application of Attic Fan for Natural Night Cooling

Dual System. The apparatus shown in Fig. 238 is so constructed that cooling coils can be added. Either a refrigerant or cold water may be the cooling medium. If a refrigerant is employed, a refrigerating machine is necessary. Where water is used it must be chilled by special machinery, or obtained from a deep well, so that it will be cold enough to produce the desired effect.

While the apparatus shown in Fig. 238 is being used for summer cooling, the blower and filters remain in operation but the steam coils and humidifier are inoperative.

Living rooms and other individual rooms can be cooled and made comfortable by the dual system.

Natural Cooling. Apparatus such as shown in Fig. 238 can be used for natural cooling by eliminating the refrigerant coils and substituting a duct to the outside, to draw in the night air and circulate it throughout various rooms of the house. This method, of course, depends entirely on the outside night temperatures, and does not dehumidify.

Fig. 239 shows how a fan or blower, installed in an attic, can be used to draw in cool night air. This method also depends on the outdoor temperature for the degree of cooling possible. It has the disadvantage of bringing dust, pollen, and like substances in with the air.

Units. Many individual room and window units are available for summer cooling. These can be obtained in various sizes and capacities.

Mechanical Systems. A number of manufacturers make apparatus which is used for both summer and winter air conditioning. These units have both heating and cooling coils, one or the other of which is inoperative, depending on the season. Steam or hot water, or refrigerant or cold water is supplied the coils as required. Blowers and filters are built in as a part of the apparatus. These systems require ducts, as in Fig. 230.

Several manufacturers also make cooling units which can be added, for use in summer, to the regular forced-air winter systems. These cooling units are usually designed to match the heating equipment, and to use the same blower and filters.

(Manufacturers' catalogs, manuals, and literature, from which all types of cooling apparatus and appliances may be studied, can be had for the asking. Methods of calculating cooling loads can be found in the A.S.H.V.E. Guide, or in *Furnaces and Unit Heaters*, American Technical Society, Chicago.)

MODERNIZING OLD HEATING PLANTS

In the following paragraphs, suggestions are given as to what can be done to modernize old heating plants, together with an outline of the entire procedure for designing mechanical systems. The mechanical system was selected because, according to trends that have been noted recently, it may be used more than any other in the future.

OLD GRAVITY SYSTEMS. With a very old gravity system there is not much to be done, ordinarily, except to tear it out and replace it with a modern mechanical system. In the long run this is cheaper, and the ultimate results in health and comfort will justify the purchase of more modern apparatus.

Occasionally as a means of economy the old wall stacks for both warm and cold air can be used in a modern system. This should not be done, however, unless they are in good condition and are located so as to give the best results and so they can be connected properly to the new apparatus.

If a gravity system is in good condition, it can be converted into a mechanical system with the benefits of forced air, filters, cool-

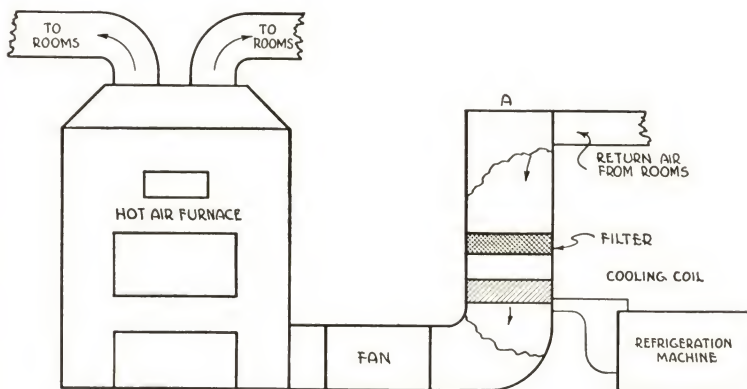


Fig. 240. A Gravity System Converted into a Mechanical System

ing or heating, and humidifying or dehumidifying, as in Fig. 240. (When converting the gravity system into a mechanical system, it is not always possible to include the furnace, blower, filter, etc., in the same housing, as specified previously for the true mechanical system. Such was the case, in the system shown in Fig. 240.)

The fan, cooling coil, refrigeration machine, filter, and the humidifying apparatus are the added features. The return-air pipes must be connected at A as shown, instead of being connected at the bottom of the furnace.

Before this method of modernization is decided upon, however, relative costs between it and a completely modern apparatus should be carefully compared.

OLD HOT-WATER SYSTEMS. Not much can be done with economy to old hot-water systems, except as explained in the following outline.

1. Add motor-driven pump and necessary automatic controls for better circulation.
2. Add modern radiators and accessories.
3. Take out old radiators in living room, or other favored rooms, and put in concealed convectors.
4. Add automatic stoker and automatic controls.
5. Change to gas or oil as fuel and use modern automatic controls.
6. Add humidifiers to new concealed convectors, as shown in Fig. 234.
7. Add vents to convectors as shown in Fig. 233.
8. Add humidifiers as shown in Fig. 235.
9. Add air-conditioning apparatus as explained for Figs. 237 and 238.
10. If boiler is not in good condition, replace with an up-to-date, automatically fired boiler with modern controls.

OLD STEAM SYSTEMS. Either one-pipe or two-pipe steam systems can be modernized into vapor systems with all the advantages listed for that system. However, in converting a one-pipe system to vapor, considerable new piping will be required, which will add materially to the cost, and in some instances will require a certain amount of tearing up of floors, or disturbing partitions.

The following items can be added to steam or vapor systems, as a means of improving them:

1. Automatic firing equipment and controls
2. New-type radiators or convectors
3. Humidifiers, as explained for Fig. 235
4. Air-conditioning apparatus, as explained for Figs. 237 and 238
5. Humidifiers to convectors, as explained for Fig. 234
6. New vents to prevent steam, water, or air from escaping into rooms, and to create an economical vacuum system
7. New modern boiler with all accessories and automatic controls

Any supply house or heating contractor will suggest other im-

provements possible to your particular system. Manufacturers' catalogs and manuals will acquaint you with types of new and modern apparatus which you may wish to consider in modernizing.

Remember that insulation is essential, as explained in Chapter IX, before true air conditioning, including humidifying and cooling, can be undertaken.

DESIGN PROCEDURE FOR MECHANICAL FURNACE SYSTEMS*

In order to explain the procedure for designing mechanical furnace systems, and to illustrate how this procedure actually is followed, calculations are made for such a system to be installed in the remodeled house, blueprints of which are in the back of this book. Specifications in Chapter III describe the system.

The design procedure consists of eight separate steps, outlined as follows:

1. Calculation of heat losses per hour for each room
2. Tentative design of the duct system, including locations of all warm- and cold-air grilles
3. Calculation of C.F.M. (cubic feet of air per minute) necessary in each duct
4. Design of warm-air grilles
5. Design of cold-air (return) grilles
6. Design of warm- and cold-air ducts
7. Use of volume dampers
8. Selection of heating unit, or furnace

EXPLANATION OF STEPS. As each step is explained, its application to the remodeled house shown in the blueprints in the back of the book is explained also.

Step 1. Heat Losses. A complete explanation of how to calculate heat losses was presented in Chapter IX, including k values, U values, gross and net areas, temperature differences, infiltration, and all other items important to heat-loss calculations.

In Chapter IX the heat-loss calculations concerned the house

*The procedure explained herein is somewhat simplified. More technical and slightly more accurate procedures can be found in the following publications:

A.S.H.V.E. Guide, New York.

Furnaces and Unit Heaters, American Technical Society, Chicago.

Technical Code—National Warm Air Heating and Air Conditioning Association, Cleveland.

Table 10. Living Room Heat Losses

Surface	Area	<i>U</i>	Temperature Difference	B.t.u. Loss per Hour
Ceiling.....	...	...	...	...
Floor.....	...	...	...	...
Net walls.....	350	.06	70	1470
Windows.....	52	1.13	70	4113
Doors.....	21	1.13	70	1661
Cracks.....	88	.51	70	3142
Total loss per hour.....				10,386

as a whole; whereas, in designing mechanical heating systems, the heat losses for each room are required. Therefore our procedure in this chapter differs to that extent. The general principle, however, is the same, and if you have studied Chapter IX, you will have no difficulty in understanding the following calculations:

The heat-loss calculations for the living and dining rooms of the remodeled house shown in the blueprints are explained in the following paragraphs, using the principles outlined in Chapter IX.

Living Room. Table 10 presents a typical form for setting down the various items used in calculating heat losses for individual rooms.

The living room ceiling need not be considered, since the second-floor areas over it are heated, and therefore no heat loss would occur through the ceiling.

The floor need not be considered, either, since the recreation room in the basement below is also heated, and no heat loss would occur.

Three sides of the living room are exposed to outside air, and heat loss will occur through these walls. To calculate the net area, you must find the gross area and then subtract the combined areas of all windows and doors.

First you find the total length of exposed exterior wall around the living room. The approximate length is 13'0" plus 21'0" plus 13'0" or 47 lineal feet.

Note. These dimensions are taken from the remodeled first-floor plan, and it should be noted that they are *approximate*. Exact dimensions and consideration for the bay in the south wall are not necessary in this type of calculation.

The remodeled west elevation drawing shows a vertical distance of 9'9" between the first- and second-floor levels. This includes

the second-floor framing. For ease in calculation consider the distance as an even 9'0".

The gross wall area is then $9 \times 47 = 423$ square feet.

Next the combined area of all living room windows and exterior doors is computed.

The door is $3 \times 7 = 21$ square feet in area. There are four windows all of which are approximately 5'0" high and 2'6" wide. Here again the approximate dimensions are accurate enough for this purpose. The area of one window is $5 \times 2\frac{1}{2} = 12\frac{1}{2}$, say 13 square feet. The area of four is $4 \times 13 = 52$ square feet.

Put the door and window areas in Table 10.

The combined window and door area is $21 + 52 = 73$ square feet. Then the net wall area is $423 - 73 = 350$ square feet. This is put in Table 10.

The crack around a double-hung window is found by adding the two sides, top and bottom, and meeting rail. For a window 5'0" and 2'6" wide the total crack length is approximately 17 lineal feet, and for four such windows the total crack length is 68 lineal feet. The crack around the door is 20 lineal feet which, added to 68, makes 88 lineal feet. This is put in Table 10.

The outside air is assumed as 0°F. and the inside air as 70°F. This is explained in the specifications in Chapter II.

The U value for the wall construction (see under *Reading a Set of Remodeling Plans* in Chapter III) plus insulation is calculated as follows:

Outside surface (f_o)	$k = 6.00$ and $R = 1 \div 6.00 =$	.17
Siding	$k = 1.28$ and $R = 1 \div 1.28 =$	.78
Sheathing	$k = .80$ and $R = 1 \div .80 =$	1.25
3½" fill insulation	$k = .27$ and $*R =$	13.41
Lath and plaster	$k = 2.50$ and $R = 1 \div 2.50 =$	.40
Inside surface (f_i)	$k = 1.65$ and $R = 1 \div 1.65 =$	.61

The total R values equal $.17 + .78 + 1.25 + 13.41 + .40 + .61 = 16.62$.

$$U = 1 \div 16.62 = .06$$

Put this value in Table 10.

The U values for windows and doors, as explained in Chapter IX, is 1.13.

*(See Table 7, Chapter IX.) The .27 is for 1" of insulation. The R value for 3½" is arrived at as follows: $R = 1 \div .27 = 3.70$. For 3½ inches the R value is $3\frac{1}{2} \times 3.70 = 13.41$.

Table 11. Dining Room Heat Losses

Surface	Area	U	Temperature Difference	B.t.u. Loss per Hour
Ceiling.....	...	...	...	...
Floor.....	169	.24	20	811
Net walls.....	186	.06	70	781
Windows.....	48	1.13	70	3797
Doors.....	...	...	...	...
Cracks.....	48	.51	70	1714
Total loss per hour.....				7,103

The *U* value for cracks, also explained in Chapter IX, can be taken as .51.

Using the data in Table 10 and the heat-loss formula given in Chapter IX the various heat losses are calculated and are as shown in Table 10.

Dining Room. Table 11 shows the heat-loss data relative to the dining room. The various areas and temperature differences are calculated somewhat as explained for Table 10.

The dining room ceiling need not be considered because the second-floor rooms above it are also heated.

The dining room floor must be considered because the laundry in the basement is not heated. It can be assumed that the laundry temperature is an average of 50°F.

The floor area is found by multiplying its length (approximately 13'0") by its width (approximately 13'0") which gives an area of 169 square feet. Put this in Table 11.

Total wall length is approximately 13'0" + 13'0" or 26 lineal feet. Then $26 \times 9 = 234$ square feet of gross area.

There is only one window. However, the French doors are glass, so they are considered as windows. The window is about 5'0" high and 2'6" wide, an approximate area of 13 square feet. The French doors have a height of 7'0" and a combined width of 5'0", and therefore have an area of 35 square feet. The combined window area is therefore 48 square feet. This goes in Table 11. The net wall area is, therefore, $234 - 48 = 186$ square feet. Put this in Table 11, also.

Crack length for the window is approximately 17 lineal feet and for the French doors approximately 31 lineal feet. The total crack length is thus $17 + 31 = 48$ lineal feet.

The temperature difference for the floor is $70^\circ - 50^\circ = 20^\circ\text{F}$.

Other temperature differences are the same as explained for Table 10.

The U value for the floor would be figured in the same manner that similar calculations were made in Chapter IX. It is found to be approximately .24.

Other U values are the same as shown in Table 10.

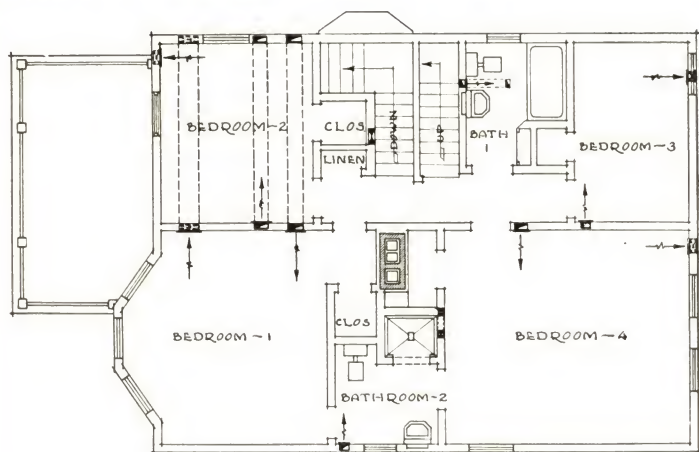
Heat losses and total loss are figured as they were for Table 10.

Step 2. Tentative Duct Design. In order to show tentative duct locations (somewhat as in Fig. 230 except that they are all plan views) and grille locations, it is necessary to draw a plan for each floor, including the basement. These plans must be made accurately to scale and the duct symbols must be drawn to scale, also. The ducts, both for warm and cold (return) air have to run up through the walls or partitions and thus connect the furnace with all of the grilles. To plan such a duct system you must be able to visualize each floor and the walls and partitions on these floors. An easy way to do this is by using tracing paper.

Put a piece of tracing paper on a drawing board and draw the basement plan. Then put another piece of tracing paper over the basement plan. Use thumb tacks only at the top. Then draw the first floor making it line up properly with the basement plan which can be seen through the tracing paper. Put another piece of tracing paper over the first-floor plan and draw the second-floor plan, making it line up with the first floor which can be seen through the tracing paper. Do the same for the third floor if there is one, as in the house shown in the blueprints at the back of the book.

When the drawings are made, all the floors can be seen, with the third-floor tracing on top of all the others. This makes it possible tentatively to locate a grille for a third-floor room and then check the possibilities of running a duct from it to the basement, keeping it within walls or partitions as required.

Grille Locations. Each room that is to be heated requires a grille for warm air. Also each room, except the bathrooms and the kitchen, requires a return-air grille. The warm-air grille should, if possible, be located on an interior partition, either at the baseboard or six feet above the floor, so that the warm air travels toward an outside wall. The return-air grilles should always be placed in outside walls, at baseboard level.

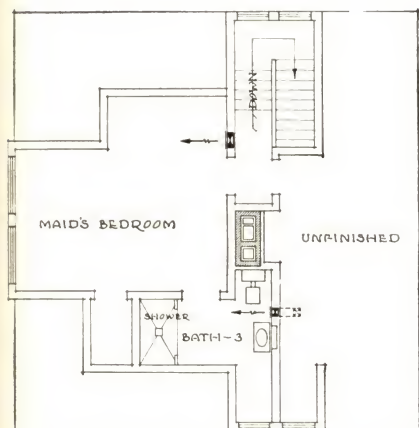


SECOND FLOOR PLAN

Fig. 243. Second-Floor Duct Layout

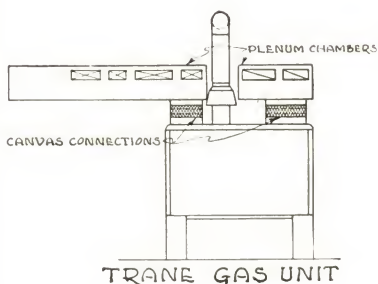
from the rooms. The symbols *R.A.* and *W.S.* mean return air and wall stack. Other common duct symbols are shown in Fig. 245.

The living room, because of its size, has two warm-air grilles and two return-air grilles, as shown. This makes for better distribution of heat and air. The dining room has one grille of each kind.



THIRD FLOOR PLAN

Fig. 244. Third-Floor Duct Layout



When the grilles have all been located to the best advantage the possibilities of running the ducts should be investigated. Various architectural or structural features make it difficult to run ducts, especially in view of the fact that they should be kept as short as possible.

In Fig. 241 the living and dining room warm-air and return-air ducts are marked (*L.R.* and *D.R.*), and the ducts have been run in the shortest possible line from the wall stacks to the plenum chamber over the furnace.

In making the first layouts for ducts, a solid single line can be used for warm air and a dotted single line for cold air. When the ducts have been designed as to size, the regular symbols shown in



Fig. 245. Duct Symbols

Figs. 241 through 244 can be drawn accurately to scale. Since the mechanics follow these layout drawings, they must be accurate.

Step 3. Calculation of C. F. M. The calculation of C.F.M. (cubic feet of air per minute) is necessary in order to determine how much warm air is required to offset the heat losses. This can be simply done by multiplying the heat loss per hour for each room by a factor depending on the register air temperature. Register temperatures of 120° are commonly used so the factor is .0184. For the living and dining rooms the C.F.M. is

$$\text{Living Room C.F.M.} = 10386 \times .0184 = 191$$

$$\text{Dining Room C.F.M.} = 7103 \times .0184 = 131$$

Thus 191 and 131 cubic feet of air per minute must be supplied to the living and dining rooms to maintain them at 70°F.

Step 4. Warm-Air Grilles. All grilles have what are called gross areas and net areas. The gross area is based on the over-all size of the

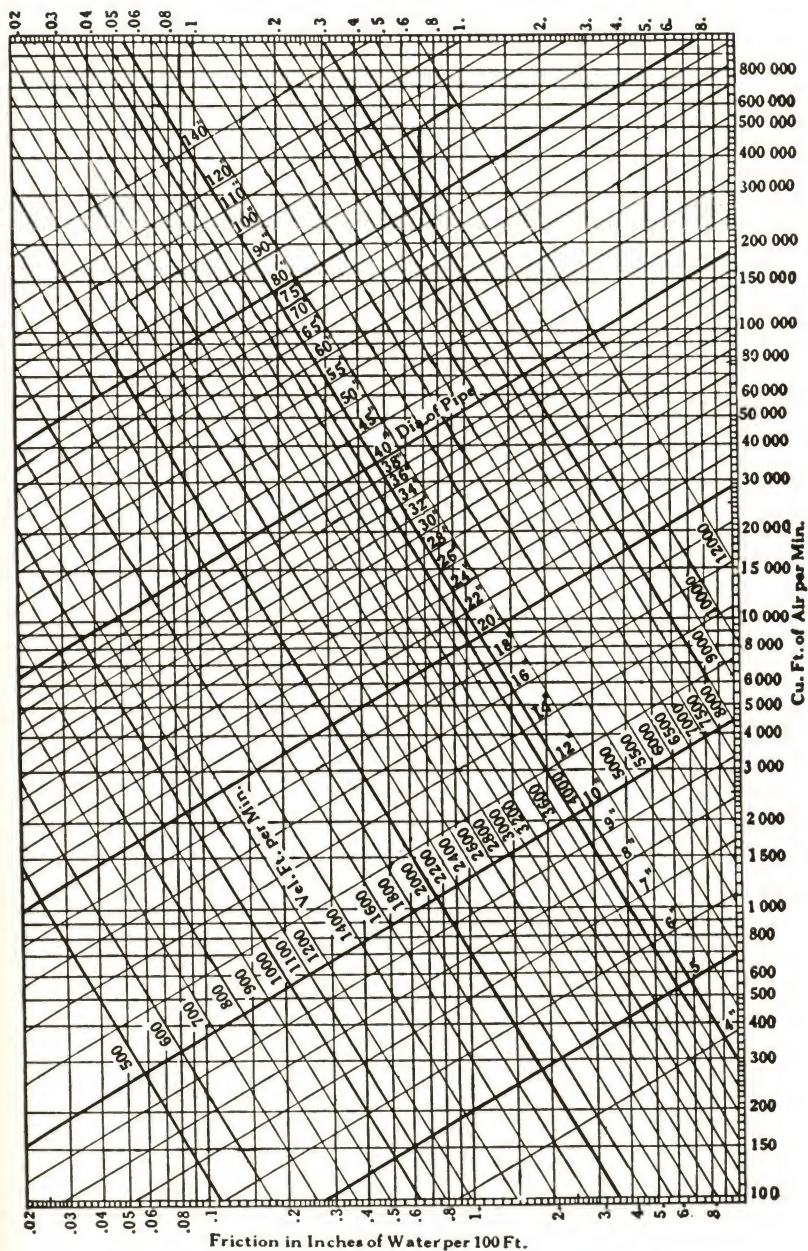


Fig. 246. Friction of Air in Pipes
 Courtesy A.S.H.V.E. Gulde, 1940

grille; the net area is the *free* area, consisting of the actual openings or the space through which air may pass.

To find the free area of a grille, divide the C.F.M. for each room by the velocity of the air in the ducts. For ordinary purposes a velocity of 550 feet per minute is accurate enough.

The living room C.F.M. must be divided in half because two warm-air ducts and grilles are employed. For ease in calculation assume that each duct has a C.F.M. of 100. Their total of 200 is only slightly over the calculated C.F.M. of 191.

Each grille must have a free area of $100 \div 550 = .18$ square feet or $.18 \times 144 = 26$ square inches

The dining room grille has a free area of $131 \div 550 = .24$ square feet, or

$$.24 \times 144 = 35 \text{ square inches}$$

Manufacturers of grilles will supply you with tables showing dimensions and free areas of grilles. Those shown in Fig. 242 for the living and dining rooms are typical.

Step 5. Return-Air Grilles. To find the free area necessary for return-air grilles, divide the C.F.M. for each room by a velocity of 350 feet per minute.

For each living room return-air grille the free area must be $100 \div 350 = .29$ square feet or

$$.29 \times 144 = 42 \text{ square inches}$$

For the dining room return-air grille the free area must be $131 \div 350 = .37$ square feet or

$$.37 \times 144 = 53 \text{ square inches}$$

The return-air grille sizes shown for the living and dining rooms in Fig. 242 are typical.

Step 6. Designing Ducts. There is an easy method of designing the required duct sizes through the use of the chart shown in Fig. 246.

Each living room duct has a C.F.M. (cubic feet of air per minute) of 100. In Fig. 246 locate a C.F.M. of 100 on the vertical scale on the right-hand side of the chart. Then assuming .1 friction (see horizontal scale at bottom of Fig. 246) move left from the 100 on the vertical scale until the vertical line above .1 is intersected. This point of intersection comes between the diagonal lines representing round pipes with 6" and 7" diameter. The point of intersection is about one quarter of the distance between the diagonal lines men-

Table 12. Conversion Table of Round Pipe Diameters to Wall-Stack Sizes (Standard*)

Round Pipe Diam.	Wall Stack Size	Round Pipe Diam.	Wall Stack Size	Round Pipe Diam.	Wall Stack Size
5.2	8x3	6.3	*12x3	8.9	14x5
5.7	8x3½	6.9	*12x3½	9.5	14x5½
5.5	*9x3	7.4	12x4	6.9	15x3
6.0	9x3½	7.9	12x4½	7.6	15x3½
5.8	*10x3	8.3	12x5	8.2	15x4
6.3	*10x3½	8.8	12x5½	8.7	15x4½
6.8	10x4	6.5	13x3	9.2	15x5
7.2	10x4½	7.1	13x3½	9.8	15x5½
7.7	10x5	7.7	13x4	7.1	16x3
8.1	10x5½	8.2	13x4½	7.8	16x3½
6.0	11x3	8.7	13x5	8.4	16x4
6.6	11x3½	9.2	13x5½	9.0	16x4
7.1	11x4	6.7	*14x3	9.0	16x4½
7.6	11x4½	7.4	*14x3½	9.5	16x5
8.0	11x5	7.9	14x4	10.1	16x5½
8.5	11x5½	8.5	14x4½	...	...

tioned, indicating that a round pipe having a diameter of 6.25 inches is required for each living room duct.

The use of round pipes is not common so it is necessary to find a rectangular duct having the same area as a round pipe with a diameter of 6.25 inches. This can be done by using Table 12.

In Table 12 notice that a round pipe having a diameter of 6.3 inches (practically 6.25) is the same in area as a rectangular (standard size) duct with dimensions of 10" by 3½". Therefore this size of rectangular duct is required for the living room. A 12" by 3" stack could also be used.

The spaces between studs, in partitions built with 2x4-inch studs spaced 16 inches on center, are only 3⅝" by 14". Therefore ducts cannot be any larger unless the studs and the spacings between them are larger. In most instances the standard sized 12" by 3½" wall stacks will be used in preference to the 14" by 3", since any slight deviation in spacing between the studs would cause difficulty in installing the larger stacks.

The dining room duct has a C.F.M. of 131. Then, by using Fig. 246 as explained for the living room ducts, you will find that a round pipe having a diameter of 6.75 is required. Reference to Table 12 shows that a rectangular duct 14" by 3" could be used. However,

in view of the preceding explanation, the 12" by 3½" stack should be used.

Return-air ducts are designed in the same manner, using the same sizes as for warm air.

Step 7. Volume Dampers. Volume dampers should be installed in each warm-air duct near the point where it is attached to the plenum chamber. These dampers are used to balance a system. No matter how well a duct system has been designed there are bound to be irregularities in the way it functions once the fan in the furnace is turned on. By the use of dampers the exact amount of air can be regulated for each room.

Step 8. Selection of Unit. The various manufacturers publish catalogs and other data useful in selecting sizes of heating units. The unit selected must be able to supply the required amount of B.t.u. and have a blower capable of operating against the total static resistance.

In designing the ducts a design static of .1 was assumed. To find the total static resistance against which a blower must operate add the following.

- .1 (warm-air side of system)
- .1 (return-air side of system)
- .03 (assumed static of grille offering greatest resistance on warm-air side)
- .02 (assumed static of grille offering greatest resistance on return-air side)
- .05 (furnace resistance)
- .10 (filter resistance)
- .40 (static resistance against which blower must operate)

The heat losses, C.F.M., and the design of ducts and grilles for the other rooms shown in the remodeling blueprints would be calculated exactly as explained for the living and dining rooms. Remember that only walls, windows, doors, ceilings, and floors which are exposed to colder than room temperatures are considered in relation to heat losses.

CHAPTER XIV

Electric Lighting and Wiring

ANOTHER item that clearly "dates" a house is its lighting. Tremendous advancements have been brought about in the research laboratories of electric companies since the drop cord and bulb from the center of the ceiling was the accepted equipment for lighting any room. Lighting improvements, therefore, will constitute an important consideration on your remodeling job.

In this chapter, an explanation of the different general methods of lighting is presented, and the recommended lighting for each room is discussed in detail. Location of the convenience outlets is considered with lighting, since much of the special or decorative lighting will depend on the use of these outlets. The chapter also includes a discussion on wiring, and an illustrative example.

DEFINITIONS. For your convenience and to clarify details of this chapter, a few terms are defined in the following:

Amperes. The unit of intensity of current in an electric circuit. All wires, fuses, switches, motors, and electrical equipment are rated in amperes.

Single-Pole Switch. A switch used in house wiring to turn an electric light on or off.

Double-Pole Switch. A switch that controls lights on two different circuits.

Three-Way Switch. A switch used in house wiring when a light (or lights) is to be turned on or off from two places. A three-way switch must be used at each place.

Four-Way Switch. A switch used in house wiring when a light (or lights) is to be turned on or off at more than two places. Thus for three places, use two three-way



and one four-way switches; for four places, use two three-way and two four-way switches; for five places, use two three-way and three four-way switches.

Three-Wire System. A single-phase alternating-current system having three wires from the pole into the house and providing both

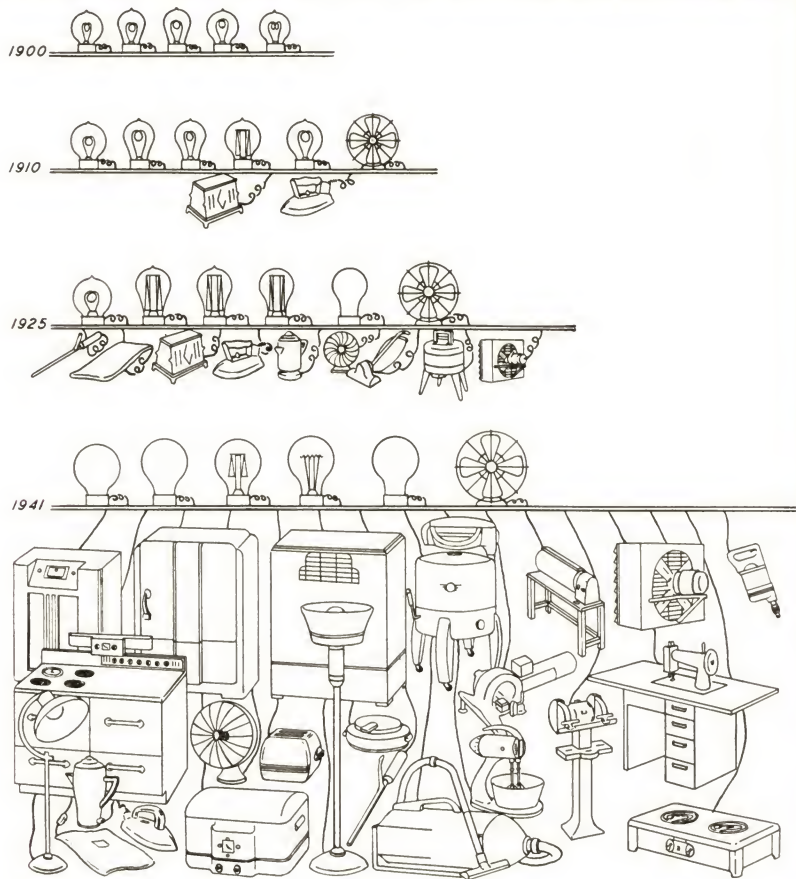


Fig. 247. Increase in Use of Electric Appliances in Home

230- and 115-volt current. Used in wiring large houses or those having an electric range, water heater, or large motors.

Two-Wire System. A system using two wires and furnishing 115 volts for lights.

Watt-Hour. Unit of electric energy. It is the work done by one watt in one hour of time. One thousand watt-hours equal a kilowatt-

hour. A kilowatt-hour is the unit used by the electric light and power company to measure current consumed by customers.

DEVELOPMENT. Before 1900, the electric equipment of a household consisted of a few lamps, usually one in the center of the ceiling of each room. By 1910 the flatiron, toaster, and small fan were used in most homes. By 1925 other appliances, including the washing machine, vacuum cleaner, electric heater, and exhaust fan, had become a part of many households. By 1941, a great many homes had acquired electric refrigerators, electric mangles, electrically operated oil burners or stokers, automatic electric toasters, and radiating electric heaters, as well as indirect lighting. Fig. 247 indicates the increased use of electric appliances in the home.

There has been an increase in energy consumption for individual items, too, as well as an increase in the number of items in use. For instance, in 1910 a flatiron had a rating of 500 watts. Today its energy consumption is 1,000 watts. The modern flatiron is equipped with an automatic thermostat which can be adjusted to various heats for ironing different materials. The electric roaster and small electric stove now being used each require 1,000 watts of energy. Modern indirect floor lamps use a 300-watt bulb, as compared to the 25- to 60-watt bulbs that were formerly used.

There is every reason to believe that this increase in the use of electric appliances and electric energy will continue. Therefore, since in remodeling a house it is wise to plan not only for today but for ten or fifteen years hence, provision should be made for wiring of sufficient size and for a sufficient number of circuits and outlets to take care of all present and probable future needs.

A good illustration of the expanding use of electricity is in the number of convenience outlets that have been added in recent years, in ordinary homes, duplexes, and apartments. In a four-room apartment built in Chicago in 1925, five convenience outlets for single receptacles were installed. By 1940 the number had been increased, through installing additional outlets as needed, to a total of 35 duplex receptacle outlets. Even so, there are still places where extra long cords or extension cords must be used to connect certain appliances. Installing these outlets a few at a time costs from three to five times as much as if they had been installed when the apartment was built. In remodeling, therefore, provide plenty of convenience outlets.

PLANNING THE LIGHTING. Planning of lighting outlets and convenience outlets will be considered together, because of the close relationship between them. Before planning any installation, it is well to obtain catalogs of electric lighting fixtures from manufacturers, or from mail-order houses. Your local electric light and power company office also displays the latest types of lighting fixtures for different rooms, and a visit to this office would be worth while.

Certain periods or styles of decoration and architecture may predominate in a room, and this also will influence your choice of the type of fixture.

There are certain general principles that you should keep in mind in selecting fixtures.

There are four general lighting systems, as follows:

1. Direct Lighting
2. Semi-indirect Lighting
3. Indirect Lighting
4. Fluorescent Lighting

Direct Lighting. The simplest form of direct lighting is the socket mounted on the ceiling, with a bare unshielded lamp bulb in it. This type of lighting produces the greatest amount of light over the largest area with the least amount of electric energy. Thus its cost, in installation and use, is least of all forms of electric lighting. A reflector may be placed back of the bulb, to reflect the light in a certain direction. This is a satisfactory light for general use in a room, especially when you are moving about the room. It does not, however, conform to modern decorative standards.

Direct lighting is not so satisfactory if you are reading, because to obtain the proper intensity of light on the reading material, you must use a size of lamp that is too brilliant and that creates a glare. The glare can be remedied by enclosing the bulb in a glass dome several inches in diameter. This reduces the brightness of the light course by increasing its surface area. Satisfactory lighting for kitchens, halls, and dining rooms is obtained by this method; the same method can be used in living rooms and bedrooms for general illumination, provided special light for reading is furnished through additional light sources. The greatest amount of shadow accompanies this form of lighting, which is objectionable for reading, writing, or other close work.

Semi-indirect Lighting. In the semi-indirect system, part of the light is reflected up from the fixture to the ceiling, whence it is reflected down through the room. Rooms using semi-indirect lighting should be decorated in the lighter colors in order to reflect the largest quantity of light. Rooms with dark woodwork and decorated in the darker shades, especially in greens, absorb a large amount of light that cannot be reflected. The annoyance from shadows is reduced considerably, because the ceiling, which acts as part of the light source, tends to diffuse the light. This type of lighting is used in dining rooms, living rooms, and bedrooms.

Indirect Lighting. In indirect lighting the quantity of light admitted through the bowl of the semi-indirect lighting fixture is further reduced, nearly all of the light being reflected down from the ceiling, or from a concealed light source which directs it to the ceiling. It is absolutely necessary that ceilings be painted white, ivory, or a very light color, and they should have a gloss or semigloss surface in order to reflect the light efficiently. The use of dark shades, and especially greens, must be avoided in walls and ceilings where indirect lighting is to be used. This kind of lighting provides the softest light, with no glare. It is usually supplemented by additional lights for reading, sewing, and similar uses.

Fluorescent Lighting. A new type of lighting called fluorescent, combining the good features of the three systems, has been introduced recently, and is already very popular for stores, offices, and factories. Sometimes it is also called tube lighting, because the lamps consist of tubes 18, 24, 36, 48, and 60 inches long. The electric energy used is about 10 watts for each foot of tube length. Thus, the 24-inch tube (two feet) uses about 20 watts.

Fluorescent tubes produce about four times as much light for the same expenditure of electric energy as the ordinary frosted light bulb. The luminous surface of a 40-watt, 48-inch fluorescent tube is 225 square inches, as compared to 20 square inches for a 40-watt ordinary inside-frosted lamp bulb. Due to this large luminous surface of the fluorescent tube, more than eleven times that of the ordinary lamp bulb, it produces a very soft light, without glare. The annoyance from shadows is reduced considerably, due to the length of the light source. This light is very restful on the eyes and reduces eyestrain caused by glare or insufficient light.

Designers of electric light fixtures soon may offer fluorescent lighting for each room of the house, because of its many advantages. They already have produced fixtures using fluorescent light for kitchen and bathroom. The use of fluorescent lighting should be kept in mind when you are planning the lighting effects and selecting the fixtures for your remodeled house.

PLANNING THE WIRING. Three different methods of wiring may be considered: knob and tube, nonmetallic sheathed cable (often called *Romax*), and armored cable (also called *BX*). Thin wall tubing or conduit and rigid conduit wiring are not discussed in this chapter, because nearly all remodeling jobs will use either *Romax* or *BX* cable.

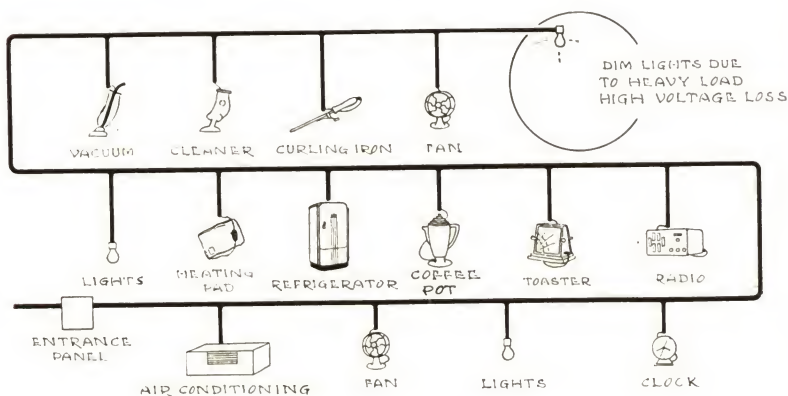


Fig. 248. Result of Failing to Plan Lighting Circuits Properly

The choice will depend on the kind of wiring used in the old house, and whether some of the old wiring and outlets are to be utilized. Thus if either knob and tube or *Romax* were used before, then *Romax* should be used on the new outlets. If either or both *BX* (armored cable) or conduit were used, then *BX* cable should be used in the remodeling. Be sure that the metal covering of all the wiring, old and new, is securely and permanently connected to the water-pipe system, forming a good ground.

You are not expected to acquire from this chapter a full knowledge of the best methods of electric wiring. However, there are certain fundamental principles which you should keep in mind in your preliminary planning of the remodeling job, if you expect completely satisfactory electrical work.

If you plan to do the wiring yourself, you should study the details in books on interior electric wiring and on job sheets or job tickets which fully cover the different operations involved.

It is seldom desirable, in electrical work, to do things the easiest and cheapest way. Too often this involves overloading of circuits by connecting too many devices on the same circuit, and other trouble-making practices. Fig. 248 illustrates one instance where all the different appliances are connected to the same circuit. This results in a flickering or dimming of the lights whenever some appliance like the refrigerator or air-conditioning unit starts operation. Especially

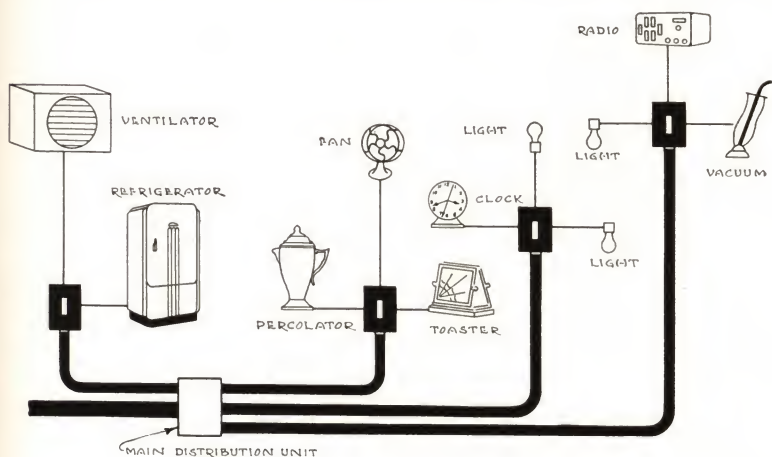


Fig. 249. Proper Arrangement of Lighting Circuits

is this true when these larger units—refrigerator motor, attic ventilating fan, air-conditioning unit, or oil burner—are located at the end of a long circuit. When these motors start up, because of the heavy current flowing through the wires for a few seconds, the voltage decreases and all the lights in the house will flicker or dim. You can eliminate this by using larger size wire, and by dividing the load up into a number of circuits from the main entrance panel or distribution unit, as shown in Fig. 249.

The convenience outlets should be placed on circuits separate from the ceiling or wall lighting outlets. The large motor-driven appliances should each be placed on a separate circuit, also. Where there is no city water pressure system, a motor-driven pump is some-

times used. A separate circuit from the main distribution or fuse panel to the pump motor should be provided in such cases.

No. 14 rubber-covered wire is the smallest size that can be used for electric wiring in houses. It has been used very extensively in the past. However, you will encounter less dimming of lights and will obtain better results by using the next larger size, No. 12, on all circuits. (No. 10 wire is larger than No. 12, since the smaller the number, the larger the size in rubber-covered wire.)

Satisfactory operation of the appliances in the kitchen, dining room, breakfast nook, pantry, and laundry can be secured by using No. 12 rubber-covered wire for the convenience outlets in these rooms. Also these outlets must be on a separate circuit from the other rooms. This is required by the National Electrical Code, and

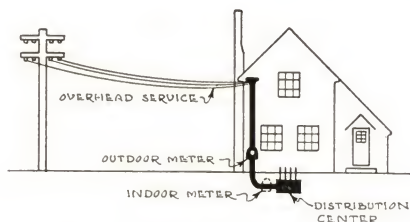


Fig. 250. Service Wiring to a House
Courtesy of General Electric Company

you should insist upon it in your remodeling. No. 12 wire should be used for the motor outlets, as well.

Outside Wires. The electric light wires from the power company's pole to the customer's house are as a rule installed by the company. This is referred to as the overhead service, or service drop, Fig. 250. You will have to install the wiring from the point where these overhead service wires fasten to the house, down to the outdoor watt-hour meter (or indoor meter) and from thence to the distribution center, Fig. 250. The power company usually furnishes the outdoor meter base or meter box to which the electric wiring is connected. They also connect and install the outdoor watt-hour meter after the wiring is completed. At the same time they usually attach the overhead service wires from the pole to your wiring.

What to Avoid. In planning a remodeling job it is well to consider the experiences of others. The electric light and power com-

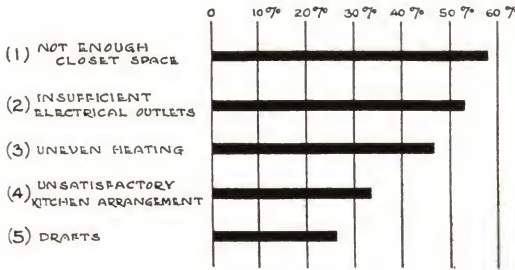


Fig. 251. What to Avoid When Remodeling a House

panies made a survey of the “pet peeves” reported in response to a questionnaire sent to 13,000 of their residence customers. These are tabulated in Fig. 251. It is notable that over 50 per cent of those who replied said they did not have sufficient electrical outlets. Over 30 per cent did not have satisfactory kitchen arrangements, and this referred not only to the arrangement of work space but included to a large extent the lack of electrical outlets. Keep this in mind in planning the electrical work for your remodeled home.

Kitchen Outlets. In the modern kitchen the work centers are arranged somewhat as shown in Fig. 252. Usually there are cupboards or cabinets above the work space on the counters, for the storage of utensils and dishes. Drawers are provided under the

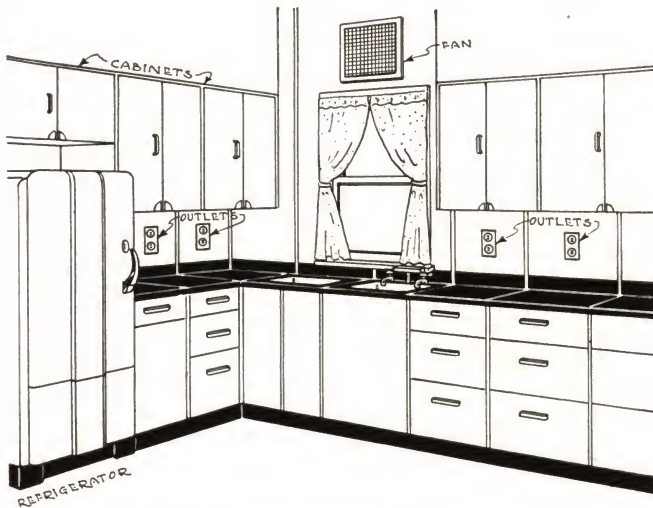


Fig. 252. Kitchen Arrangement in Modern House

counters. Most of the electrical appliances, such as coffee makers, toasters, waffle irons, and like equipment are stored in the cabinets.

A number of electrical outlets should be provided at the back of this work space, so that appliances can be attached conveniently. These outlets may be ordinary duplex receptacle outlets, or they may be of the "plug-in" strip type. One type of "plug-in" strip, adapted to this purpose, is shown mounted in the baseboard in Fig. 253. This "plug-in" strip comes with outlets 6 inches, 18 inches, or 3 feet apart. You can use it with two pieces of metal molding, similar to that piece shown at the top in Fig. 253, and mounted around the kitchen at chair-rail height, or on the wall above the work counters. Another

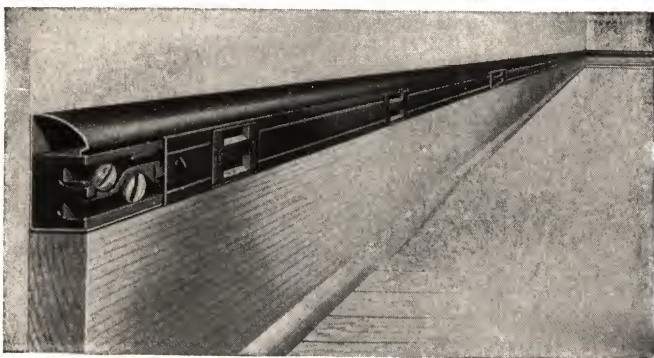


Fig. 253. "Plug-in-Strip" Baseboard Method of Wiring
Courtesy of National Electric Products Corp., Pittsburgh, Pa.

type, "plug-in anywhere" molding (Plugmold), is shown in Fig. 254. It is a metal trough, and an electrician can arrange the outlets any distance apart, after which the metal cover is cut and placed in position.

The cost of "plug-in" strip and "plug-in anywhere" outlet wiring is higher than for individual wall receptacles. However, if outlets are to be located within four or five feet of each other, the cost figures about the same. The great advantage of these "plug-in" strips or "plug-in anywhere" systems is that they make provision for enough outlets, so that you will not have to cut into the plaster or walls every time an extra outlet is needed. These systems provide a metal enclosure for the wires, also, reducing the hazard of fire from defective wiring.

Practically all of the convenience outlets in the kitchen, breakfast nook, and pantry are mounted at chair-rail height. This includes the outlet for the electric refrigerator. If possible, provide more outlets than will be in constant use. It is convenient to be able to attach one appliance without having to detach another, or without reaching around an appliance already in use.

Kitchen Lighting. Kitchen lighting is usually from an overhead fixture, located in the center of the room. If there is a pantry, install

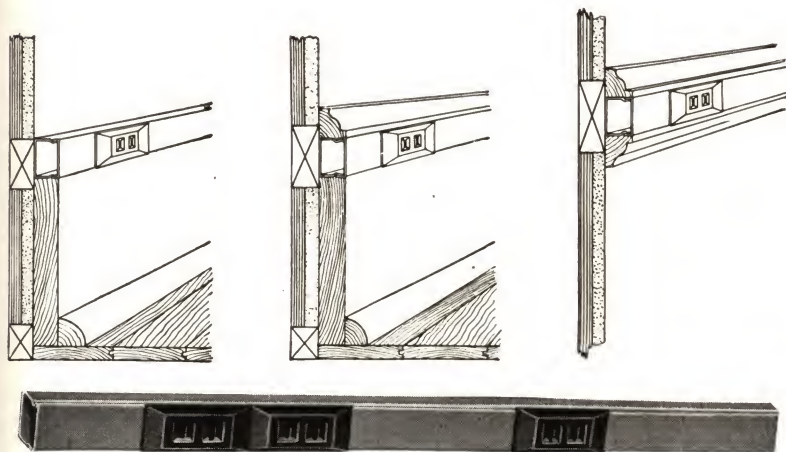


Fig. 254. Upper Left, Plugmold on Top of Baseboard without Molding. Upper Center, Plugmold on Top of Baseboard with Molding. Upper Right, Plugmold Mounted at Chair-Rail Height. Bottom, Plugmold Strip Wiring with Outlets at any Desired Point

Courtesy of The Wiremold Company, Hartford, Conn.

an additional light in a central location there. Modern fluorescent lighting can be used to excellent advantage in kitchens.

Additional lighting should be provided for work counters, especially if there are overhead cabinets to shadow the area. Fluorescent tube lighting can be mounted on the underside of these overhead cabinets. This will provide plenty of light without glare, also it will not give off as much heat as the ordinary lamp bulb.

Make a sketch or drawing showing the location of the different pieces of equipment and furniture in the kitchen. Indicate the electrical outlets on this drawing by the usual symbol. (Fig. 255.) It is cheaper to make several pencil sketches than to find that you have located an outlet in the wrong place in relation to equipment.

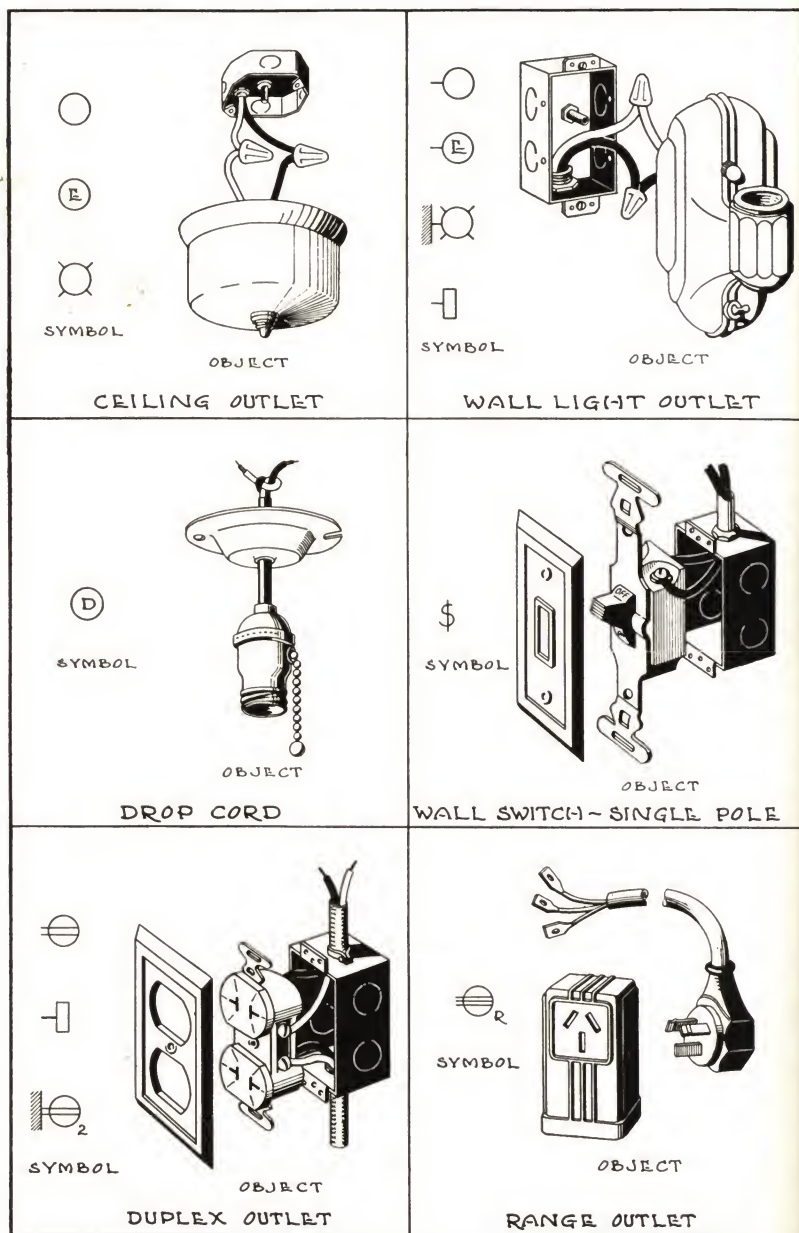


Fig. 255. Electrical Symbols Used in House Plans

The ceiling light should turn on and off by a wall switch near the door leading into the kitchen. The other lights can turn on from a switch in the same location as the overhead light switch, or they can be turned on individually, at each light. The latter arrangement is usually preferred.

Dining Room Lighting. The usual lighting for the dining room consists of a central ceiling outlet with a fixture over the dining room table. This is controlled by a switch near the door leading into the room. Certain electrical appliances, such as the toaster or coffee maker, will occasionally be used at the dining room table. Provide



Fig. 256. Result of Failing to Provide Proper Number of Convenience Outlets

*Courtesy of National Electric Products Corp.,
Pittsburgh, Pa.*

a sufficient number of convenience outlets, either in the baseboard or mounted 14" above the floor. The "plug-in" strip or "plug-in anywhere" metal molding around the baseboard, Figs. 253 and 254, affords an adequate and convenient arrangement, and is suggested for use in remodeling.

Even the lowest-priced house should have at least one outlet on each dining room wall. Provide an outlet six feet from the floor, in the most desirable location for attaching an electric wall clock. You may want to use some type of ornamental lighting on one or more walls. With a sufficient number of convenience outlets provided, supplementary or ornamental lighting can be mounted at the desired location on the walls and quickly attached. Avoid the hazard and inconvenience involved in using only one or two outlets, illus-

trated in Fig. 256. It is an unwise and dangerous practice to run electric wires under rugs. Such wires must be renewed every two or three years, and in addition, the bulges in the rug will cause it to wear thin over the wires. This practice is one of the commonest causes of fires.

Sometimes a convenience outlet is placed in the center of the dining room floor, under the dining room table. A connection cord reaches from the dining room table to this outlet. Convenience receptacles can be mounted around the edge or underside of the table, for plugging in the electric appliances used at the table. One disadvantage is that dirt will tend to get into the floor outlet and cause trouble. Also, it is necessary to cut an opening in the rug for the cord, if a large rug is used in this room. Therefore the use of a sufficient number of convenience outlets around the wall is a more desirable and more permanent installation than a floor outlet.

Living Room Lighting. A living room is lighted most effectively by a ceiling outlet in the center of the room, supplemented by additional lighting from floor lamps. If your living room is rectangular you may want to provide two ceiling outlets instead of one. The type of lighting fixture chosen for the ceiling outlet depends on the style of furnishings and decorations to be used in the room.

At one time it was the fashion to install one or two bracket outlets on each side wall, rather than using a ceiling outlet. This arrangement did not, however, provide satisfactory lighting, especially since only the 25-watt ornamental type bulbs could be used with the bracket lights. The small quantity of light from these was not sufficient for general use in the room. It is much better to omit the bracket outlets and provide a generous number of receptacle outlets around the walls of the room.

The ceiling outlets should be controlled by a wall switch near the door into the living room. If your living room has two doors, used about equally, install a three-way switch beside each doorway. If there were more than two doors into the rooms the lights could be controlled near all the doors by using three-way and four-way switches.

In some rooms, several of the wall plugs or convenience outlets are controlled by a wall switch near the door; one like that which controls the ceiling lights. In this way the floor lamps attached to these

plugs can be turned on in one operation. However, there should be some convenience outlets in the living room that are not controlled by such a wall switch. To these, such devices as the electric clock and the radio should be attached. It is a matter of great convenience for some of the receptacle outlets to be controlled by a wall switch in cases where a central ceiling fixture is not used.

Living Room Outlets. In remodeling, it is important to provide a sufficient number of living room outlets. The very least number that should be used, even in the smallest and most inexpensive house, would be one to each wall. Even in modest houses, it is better if the outlets in the living room are not more than six to eight feet apart. Most floor lamps come equipped with only a five-foot cord, so the outlets must be located rather close together in order to provide proper light where it is needed.

In homes where several floor and table lamps, a radio, and a clock will be in use, the "plug-in" strip molding, shown in Figs. 253 and 254, should by all means be considered. With the "plug-in" strip molding as shown in Fig. 253, the duplex outlets are located three feet apart. The "plug-in" strip molding forms part of the baseboard molding, running all around the room the same as the baseboard. There are various ways of installing the "plug-in anywhere" molding around the baseboard in addition to the one illustrated in Fig. 254. The outlets should be located about 4 to 5 feet apart. Should additional outlets be needed later, they can be installed readily by removing the metal molding cover and installing an outlet midway between two others.

The cost of the "plug-in" strip wiring is a little more than if individual outlets are installed six feet apart. However by this method of wiring, additional outlets that might be wanted in the future could be added without cutting into or marring the walls. Wherever it is desirable to locate convenience outlets less than six feet apart, one of the "plug-in" types should certainly be used. This is the most desirable method of installing outlets. It is impossible to plan permanent locations for lamps and other appliances that may be attached along the wall, because different arrangements of the furniture will be used. Therefore, it is best to provide enough outlets so that the lamps and other fixtures can be attached conveniently without having any light cords lying along the floor or under rugs.

Bedroom Lighting. A ceiling outlet in the center of the room is usually provided to furnish light for cleaning, and for general use. It should be controlled by a wall switch near the entrance door.

A semi-indirect lighting fixture usually is preferred, as the light is softer and not so glaring. When direct lighting is used, usually a two- or three-socket fixture is mounted at the ceiling, in which 25-watt or 40-watt frosted bulbs of large diameter are used. These bulbs are larger in size and do not have as much glare as the regular inside-frosted lamps.

Convenience outlets should be provided around the walls of the room, depending upon the possible arrangement of the furniture. There should be an outlet at the head of the bed, for attaching an electric heating pad during illness, as well as for the attachment of the "pin-up" type of portable lamp for those who like to read in bed. Since the bed is likely to be placed in different parts of the room from time to time, an outlet should be provided at each probable location. You should plan for an outlet in each place where dresser, chiffonier, or chest of drawers is likely to be located. Then a small dressing lamp for use over the mirror can be attached to a near-by outlet.

If desired, a 12-inch lumiline lamp or fluorescent lamp can be permanently attached at the head of the bed or over the mirror of the dresser. This is recommended only when the arrangement of doors and windows in the room is such that there is practically no choice of position for bed and dresser. In a room that has possibilities for several attractive arrangements of these major items of furniture, it is better to provide a sufficient number of outlets so that floor lamps, bed lamps, or the popular "pin-up" lamps can be conveniently attached.

If there is a large mirror in the bedroom, it is well to place a lumiline or fluorescent tube light on each side of the mirror. You can attach these to the wood frame of the mirror, or to an extension at the back of it. If possible, a convenience outlet plug should be installed directly below these lamps, so that an electric razor can be used. The fluorescent or lumiline tube lamps could be permanently attached to the wall, but usually it is more practical to install them on the mirror and use a cord to attach them to the convenience outlet at the baseboard. If this type of lighting is provided for the mirror in the bathroom, it may be omitted in the bedroom.

Bathroom Lighting. A ceiling outlet is used in the center of the bathroom. Usually it is fitted with a round bowl or dome-type light, controlled by a switch near the doorway. The usual location of the switch box is shown at *A* in Fig. 257; and the plate covers the switch box and the opening in the wall. However, it is inconvenient to have to reach around the corner of the doorway in the dark and feel for the switch. A much better way is to have the switch box installed in the door frame. A shallow switch box is used, and it is mounted by boring through and chiseling out the wooden door frame. The switch

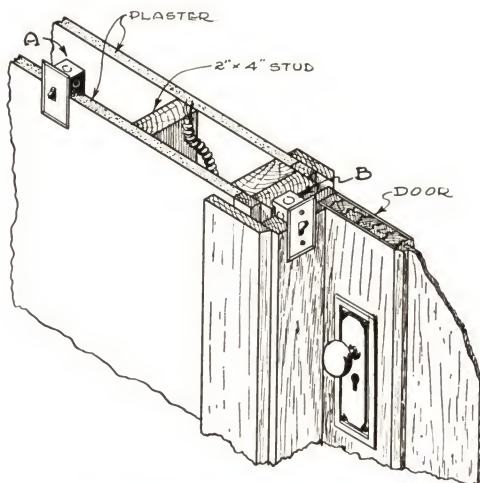


Fig. 257. How to Install Switch in Door Frame

box is fastened to the frame as shown at *B* in Fig. 257. A hole is drilled through the left-hand 2x4 stud so that the cable can enter through it. By this arrangement, a ceiling light or the lights along the mirror can be easily and conveniently turned on or off.

Mirror Lights. It is desirable to provide additional localized lighting at each side of, or over, the mirror in the bathroom. This mirror usually is in the door of the medicine cabinet, over the lavatory. Lumiline tube lamp or fluorescent tube lamps are very satisfactory for this purpose. Best results are obtained by using two tubes, one on each side of the mirror. The 24-inch (20-watt) fluorescent lamp is preferable, because the outside diameter of this tube is $1\frac{1}{2}$ inches, as compared to a 1-inch diameter for the 18-inch (15-

watt) or the 36-inch (30-watt) tubes. The larger diameter of the tube reduces the brilliancy and glare from this light.

Basement Lighting. The ceilings of most basements are low, and lights must be placed up close to the ceiling. In the past, a key or pull chain lamp socket on the end of a drop cord from a ceiling outlet was the customary lighting. This was all right as long as the typical basement contained a coal bin, a coal-fired furnace, and a hot-water heater, along with an accumulation of odds and ends no longer in use. The basement of a modern house, however, has become a recreation center for the younger members of the family, and for some who are not so young, or it may be used as a shop by the mechanically inclined, or perhaps as a den or studio. Attention, therefore, must be given to modern basement lighting.

A fluorescent tube light can be mounted in the ceiling without shielding glass; this will provide a very efficient light source. Where the lighting unit will be used several hours a day, the increased cost of the fluorescent light fixture will be saved in a year or two by the smaller amount of electricity consumed.

In a house where the basement lights are used only a few minutes a day, simple ceiling outlet fixtures will be satisfactory. These lights should not be more than 12 feet apart. If the basement is divided into separate rooms, each should have a ceiling outlet, in the center. If any room is twice as long as it is wide, a ceiling outlet should be located in the center of each half of the room. If bulbs larger than 60 watt are needed for special lighting, it is best to use a large dome shade.

ILLUSTRATIVE EXAMPLE

In order further to explain the designing of electrical work, and to show you how the foregoing principles are applied on an actual job, the following paragraphs outline the electrical work required in the remodeled Jones house described in Chapter XVII and in the blueprints at the back of the book.

These blueprints, plates 1A through 4A, show the location of electrical ceiling, bracket, switch, and receptacle outlets. Ceiling and bracket fixtures are to be installed at these outlets. They will be of a type selected by Mr. or Mrs. Jones. A duplex convenience receptacle is to be installed at each receptacle outlet. Plates that cover switch and receptacle boxes may be of brass or chromium, or of glass or bakelite. (In this example the plates were specified to be bakelite, which comes in many colors and will probably be selected to match the colors of the walls.)

Only the minimum number of outlets actually needed are shown in this illustrative example.

Specifications. The electrical specifications were outlined in Chapter III. They may be summarized briefly as follows:

Service

Complete new system of electric wiring
New 30-ampere, three-wire service
Meter on exterior of building
Conduit from meter to basement panel board
A 30-ampere cutout switch
Safety-type block fuse panel board
Panel board with two spare circuits

Wiring

No. 12 BX cable for receptacle outlets in laundry and dining room
No. 14 BX cable for all other branch circuits
Switches—silent-type toggle
Garage—overhead wiring from house to garage on separate branch circuit

Bells

New front and rear doorbells operated from bell-ringing transformer. Bell located in hall and in the kitchen. Use two-tone bells.

Telephone

Run $\frac{1}{2}$ " conduit from bedroom 1 to basement.

Fan

Install 10" kitchen ventilating fan.

Permits

Secure certificate from National Board of Fire Underwriters.

Size of Service Wires. The National Electric Code requires that the size of service wires shall not be smaller than No. 8. This size of rubber-covered wire has a current-carrying capacity of 35 amperes. If the load is greater than this, the next larger wire, No. 6, which has a current-carrying capacity of 45 amperes must be used.

The size of service conductors and the size of the feeders to the fuse panel are determined by the following rules from the National Electric Code:

"Allow 2 watts per square foot of floor area (exclusive of unoccupied cellar, unfinished attic, and open porches), plus a small-appliance load of 1,500 watts, plus a fixed-appliance load, such as oil-burner motor, stoker motor, air-conditioning motor, etc." The floor area is calculated from the outside dimensions of the building and the number of floors that are finished off and used.

The floor area of the remodeled Jones house is computed as follows:

Basement playroom—26'4"×14' (outside).....	369 sq. ft.
First floor—34'1"×26'4".....	898 sq. ft.
Second floor—same.....	898 sq. ft.
Third floor—approximately.....	300 sq. ft.
Total floor area.....	2,465 sq. ft.

The loads are:

Lighting load—2 watts per sq. ft.....	4,930 watts
Small appliance load.....	1,500 watts
$\frac{1}{4}$ h.p. motor on heater.....	250 watts
Total electrical load.....	6,680 watts

Estimated Current: $6,680 \text{ watts} \div 230 = 29$ amperes, using a 115/230 volt three-wire service.

Since No. 8 will carry up to 35 amperes (National Electrical Code), it is large enough for this installation.

Number of Circuits. One method of determining the number of circuits needed in a house is to divide total load (in watts) by the voltage of branch circuits. Then divide this answer by maximum current (in amperes). For the house of this Illustrative Example, the total load of 6,680 is divided by 115 (the voltage of the branch circuits), which will give 58 amperes. The maximum current allowed on a branch circuit in a residence is 15 amperes; thus, $58 \div 15 = 3.9$, which shows that 4 two-wire branch circuits of 15 amperes each would be required. This is the minimum that could be used.

A better rule is to allow a branch circuit for each 500 square feet of floor area. Thus the floor area, 2,465, divided by 500 equals 4.9 or 5 circuits. This is in addition to the appliance circuit in the kitchen and dining room using No. 12 wire, plus separate circuits for the heater motor and for the light in the garage. The specifications call for two spare circuits that are not to be used now, but which may be needed in the future. Thus either an 8-circuit or a 10-circuit fuse cabinet could be used.

Locating Meter. There are several things to consider in determining the most desirable point at which to attach the service conduit and the power company's watt-hour meter. If the electric light wires and poles are located at the rear of the house, a place should be selected where:

1. The watt-hour meter can be read without injuring flower beds.
2. The service wiring can be attached to the house *at least* 10' (preferably 15' to 25', but not over 30') above ground.
3. The service wires will not be near windows, or where they might be touched by anyone leaning out of a window or on porches—especially second-story porches.
4. The service wiring and meters are as near as possible to a desirable location for fuse cabinets and distribution cabinets.
5. The service switch and fuse box should be as near as possible to the location where an electric range might be installed in the future.

Locating Entrance of Service Wiring. If the pole to which the service wires or service drop will be attached (by the power company) is located directly back of the house or at the right-hand corner of the lot, then the service wires would be located on the rear kitchen wall and at the east (left-hand side) of the northwest kitchen door. The watt-hour meter should be installed about five feet above ground, which would be on a level with the top of the iron railing (see Plates 2A and 6A) and about midway between the two porches. The service switch and fuse panel board would then be located in the basement on the north outer wall directly below the meter.

The disadvantage of this location in the basement is that should it become necessary to replace fuses, someone would have to go down to the basement and cross the room, maybe in the dark. Some of this space might be used as a storage room, with the danger that boxes and furniture would be piled up in front of this fuse cabinet. Replacing of fuses would be a task in such a case. It would be better therefore, to mount the fuse cabinet in the wall of the kitchen, just east of the outer kitchen door. See Plate 2A. Here, there would be little likelihood of objects getting piled in front of the fuse cabinet.

If the power company has a pole located on the northwest corner of the lot at the rear, we should probably install the service conduit on the west side of the house (see Plate 8A) at about the height of the second floor and directly below the window on the second floor. We should locate the watt-hour meter directly below the service wires and between the kitchen window and the door to the basement (see Plate 8A). It would be mounted on the outside of the building, about 5' above the ground, which would be 2' to 3' above the first floor. The service switch and fuse panel could be located about 5' above the landing on the stairs between the first floor and basement, back of the door as shown in Plate 1A. (The position of the same fuse box is shown in Plate 2A.)

This is a very desirable location, because should an electric range ever be installed it would probably be located in the same position as the stove in Plate 2A, and it would be easy to run the range circuit from the stove into the stair wall and to the fuse panel. Also, this is a more central location from which to run the branch circuits to the other rooms in the house. The distance from this fuse panel to the outlets is less than it would be if the fuse panel were at the side of the outer kitchen door, as first considered. The stair well extends to the ceiling of the third floor, providing splendid concealment for the wires. Also, if an electrician is called to replace fuses or make repairs, he does not have to go through the house, but can enter the side door near the fuse cabinet. (Plate 2A)

Locating Outlets. *Laundry.* The ceiling light at the bottom of the basement stairs, shown in the remodeled floor plan for the basement, is controlled by a switch at the top of the stairs. There are three lights in the laundry and furnace room, and a convenience outlet for the use of washing machine and ironer near the laundry trays. The ceiling lights are controlled by a switch near the entrance door. The convenience outlet near the laundry trays is best connected to the dining room convenience outlet directly above, as shown. No. 12 BX cable must be used for wiring the dining room and the laundry outlet, also. The laundry outlet should be located at switch-box height, about $4\frac{1}{2}'$ above the floor.

A separate circuit should run from the fuse box to an outlet over the new furnace, which would preferably be connected in the ceiling. An extension of BX cable can run from the outlet box down to the motor on the furnace, when the furnace is installed.

Playroom. A switch, on the wall of the playroom near the doorway, controls the two ceiling lights. Since this room is about twice as long as it is wide, it will be better to use two lights and place them as shown in the remodeled basement plan.

The National Electric Code requires that "receptacle outlets shall be installed in every kitchen, dining room, breakfast room, living room, parlor, library, den, sun parlor, recreation room, and bedroom. One receptacle outlet shall be provided for every 20 linear feet or major fraction thereof of the total (gross) distance around the room as measured horizontally along the wall at the floor line. The receptacle outlets shall insofar as possible be spaced an equal distance apart." Thus four outlets are required in the playroom, conveniently arranged as shown by the small rectangular symbols in Plate 1A.

If the building is located on a level where there is any danger of water getting into the basement, the receptacles should be located at switch-box height, $4\frac{1}{2}'$ above the floor. Otherwise, locate them 14" above the floor.

Kitchen. A center ceiling outlet is to be provided in the kitchen, and also an outlet over the sink near the wall. A bracket fixture will be used at the outlet over the sink, controlled by a switch under the cupboard and to the left of case-

ment windows. The center kitchen outlet is to be controlled by 2 three-way switches, one at the rear exit kitchen door, and the other at the door into the hallway from the kitchen. A single-pole switch will be located beside the three-way switch at the rear kitchen door, to control a bracket light mounted outdoors, over the rear porch.

Four receptacle outlets will be provided in the kitchen. The outlets over refrigerator and stove should be mounted at a height of about 6 feet, so that the cords of the devices can be attached conveniently. The outlet over the stove will serve the electric fan which is to be installed over the sink. Other outlets will be mounted a few inches above the kitchen sink work table, and under the cabinets. The outlet in the north wall should be mounted at switch-box height. This outlet will ordinarily be used for connecting household appliances such as the iron, waffle iron, toaster, or coffee maker. Switch-box height is more convenient than if the outlet were in the baseboard or slightly higher.

Dining Room. A ceiling outlet will be located in the center of the dining room, controlled by a switch near the hall leading to the living room. Three convenience outlets will be provided in the dining room, mounted either in the baseboard or about 14" above the baseboard.

On the north dining room wall, and outside the building, a weatherproof receptacle outlet will be connected to the same circuit. The outlet in the laundry will be connected to the outlet on the east wall of the dining room, as it is directly below it. All of the receptacle outlets, in dining room, kitchen, and laundry, are to be wired with No. 12 BX cable. According to the Code, the minimum number of outlets that may be installed in the dining room is three. Another one might be installed on the north wall, between the new French door and the east wall.

Powder Room. Two bracket outlets will be placed on the south wall of this room, controlled by switches in the lighting fixtures. Outside the room, in the passageway between the dining room and living room, a ceiling outlet will be controlled by a wall switch.

Living Room. No ceiling outlets are to be installed in the living room. Instead, some of the receptacle outlets will be controlled by 2 three-way switches and a four-way switch. One three-way switch is to be located near the door opening on the front porch; a four-way switch is to be on the west wall at the foot of the stairway to the second floor; and a three-way switch will be at the head of the stairs, on the second floor. The outlets controlled by these switches are shown by connected dash lines.

Such an arrangement of switches permits anyone entering or leaving the front door to turn lights off or on; the same can be done by the switch at the foot of the stairs. The living room lights can likewise be turned off or on from the top of the stairs on the second floor, Plate 3A.

There will be four additional receptacle outlets in the living room which are not controlled by these switches. Another outlet, marked *Hot Radio*, will contain, in addition to the circuit for operating the radio, a special receptacle to which the aerial and the ground of the radio are connected.

The living room lighting will be obtained by the use of indirect lighting from floor lamps. It is desirable to have one or more floor lamps attached to the outlets controlled by the three-way and four-way switches.

Stairs. A ceiling outlet is to be located on the second-floor ceiling above the landing of the stairs leading from living room to second floor. This is controlled by 2 three-way switches, one of which is shown on Plate 2A and the other on Plate 3A.

This enables anyone to turn the light on at the foot of the stairs when starting up, and to turn it off after reaching the second floor. The hall at the head of the stairs will be lighted by a ceiling outlet controlled by a switch between that stairs and the stairs leading to the third floor, Plate 3A.

Bathroom 1. This bathroom will be lighted by means of bracket lights over the wash basin and along the side of the medicine cabinet and mirror. These are turned on and off by a switch on the opposite wall.

Bedroom 3. A ceiling light, in the center of the room and controlled by a switch near the door, will be used for general lighting. There will be two convenience outlets, one on the west and one on the east wall.

Bedroom 4. A ceiling outlet in the center of the room, controlled by a wall switch near the door from the hall, is to be used for general lighting. There will be three convenience outlets in this room. This is the minimum permitted by the National Electrical Code requirement of "one outlet for every 20 feet." It might be desirable to have an outlet on the north wall, also, between the two windows.

Bathroom 2. The ceiling light in this bathroom will be controlled by 2 three-way switches, because there are two entrances to this room. There will be two bracket outlets, also, one at each side of the medicine cabinet mirror over the wash basin. These will be controlled by individual switches on the bracket fixtures.

Bedroom 1. A center ceiling fixture will be used, controlled by a switch at the side of the door into the hall. The three convenience outlets can not be spaced a uniform distance apart, because the south wall of the room is nearly all windows. As this bedroom will probably be used the most, it might be desirable to have a fourth convenience outlet, near the baseboard below these windows.

It would also be desirable to have a light in the clothes closet of this bedroom. This should be a ceiling light, turned on and off by a pull chain switch, for in most cases a closet does not warrant the expense of a wall switch. Such a ceiling light could be used in the clothes closet of bedroom 2, also.

Bedroom 2. The center ceiling light will be controlled by a switch near the door, and there will be three convenience outlets on the walls. None is located on the north wall, because the space between closet door and entrance door is hardly sufficient for the location of a chest of drawers or other furniture which might require a light over it.

Third Floor. Storage room. Only part of the third floor is finished. In the unfinished room, which will probably be used as a general storage area, a ceiling outlet and light, controlled by a switch near the entrance, should be installed.

Maid's Room. A ceiling outlet, controlled by a wall switch, will provide general lighting. Convenience outlets are to be installed, one on the east and one on the west wall.

Bathroom 3. Two bracket outlets, one on each side of the mirror over the lavatory, will provide the lighting; these to be controlled by individual switches at each light.

This completes our design of the minimum requirements for electrical wiring in the remodeled Jones house. Nothing less complete should be installed on any comparable remodeling job. You will find that reducing the number of outlets to save a dollar or two is the poorest possible economy in the long run.

The total effect of this improvement, of course, depends to a certain extent upon the care and good taste with which the lighting fixtures are chosen.



A WELL-DESIGNED WINDOW AND DOOR TREATMENT AND CORNER CHINA CUPBOARD
Courtesy of Curtis Companies, Incorporated, Manufacturers of Curtis Woodwork, Clinton, Iowa

CHAPTER XV

Remodeling Rooms

ASIDE from the desire to modernize bathrooms and kitchens, the most common reasons for remodeling individual rooms are to be found among the following:

1. To enlarge them. This is especially true of living rooms.
2. To remove "gingerbread" ornamentation of the type popular some years ago
3. To make them conform to a new type of architecture
4. To reduce their size. This is especially true for kitchens, and for bedrooms where dressing rooms are desired.
5. To make two rooms from one large one
6. To alter their shape, for the sake of efficiency and comfort
7. To alter their shape for better furniture arrangement
8. To alter their shape for greater privacy and better closet facilities
9. To rearrange rooms so that the living room, for example, may secure the benefit of more sunshine or a better view
10. To make possible the use of modern materials

To accomplish any of the above objectives, you must follow two distinct lines of thinking and planning.

First, each room must be thought of and planned purely from the standpoints of efficiency and appearance, as follows:

1. Relation to architectural type upon which the remodeling is based
2. Relation to other rooms and to the complete floor plan
3. Furniture arrangement
4. Uses for which the room is intended
5. Kinds of materials to be used, and general appearance

Second, most remodeling changes must



be considered from the structural standpoint, which includes the following items:

1. Positions of bearing partitions
2. Joist framing
3. Service pipes in partitions
4. Position of stairs
5. Roofs
6. Strengths of framing

To make these necessary processes of thinking and planning clear to you, this chapter explains numerous miscellaneous items of importance, items directly related to specific rooms, and typical examples based upon the actual remodeling of representative rooms.

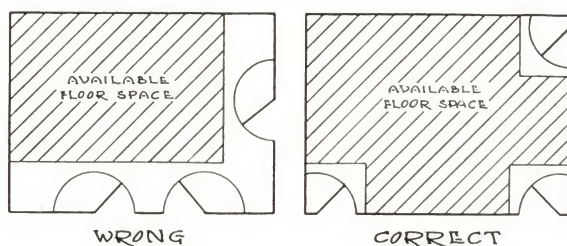


Fig. 258. Wrong and Correct Way to Locate Doors

You will understand this chapter better if you have studied the preceding chapters carefully.

MISCELLANEOUS CONSIDERATIONS

There are numerous miscellaneous items which should be considered in relation to the remodeling of individual rooms. You must understand the most common of these in order to avoid mistakes, to save time, and to plan the remodeling of each room to the best advantage, thus assuring the success of your complete remodeling job.

POSITIONS OF INTERIOR DOORS. It is easy to overlook the importance of door locations. Living rooms and bedrooms frequently require two or three doors. These, if placed without careful thought, take up more room than necessary, thereby cutting down usable floor space and perhaps causing difficulty in the arrangement of furniture.

Fig. 258 shows a typical room, first with the doors placed wrong, and second with the doors planned correctly. The lined areas show the

available floor space in each case, after deducting the necessary room for opening the doors. You can see that by placing the doors in the corners, a considerable area of usable floor space is saved. The same principle applies to the placing of casement windows that open inward.

In Fig. 258 note that the doors can be partly open and still provide a certain amount of privacy. This feature is important in bedrooms.

MILLWORK FOR WINDOWS AND INTERIOR DOORS. In remodeling various rooms, it often happens that some additional windows and doors are required, while some are to be removed, and walls built up to replace them. In such cases the old frames and trim should be used in the windows designed for new locations, providing the old frames and trim are in good condition. This is a true economy for frames and trim must match throughout the house, and making them of new material, to match the old, might require costly special millwork.

STAIRS. Where it is at all possible, plan the remodeling of your rooms so as to avoid the necessity for an entirely new or relocated stairway. Installing a new stairway or relocating an old one is expensive, and might bring your remodeling costs too high. Parts or flights of old-style stairs, however, can be replaced without great cost. This is often advisable when they come down in the living room, or are visible from that room. Where stairs have a landing halfway up, the lower flight can be modernized without a major stair building job. The exception to the foregoing is that if your stairs are hazardous or too poorly located, they must be replaced regardless of cost, in the interest of safety and sound planning.

BEARING PARTITIONS. To enlarge living rooms or to make room for basement recreation rooms, bearing partitions or columns sometimes must be removed. In such a case, as explained in Chapter VII, some form of beam or girder must be designed and placed to support the loads.

This matter will require some very thoughtful attention; do not take any proposed changes for granted without careful preliminary investigation. There are cases where beams or girders cannot be substituted. In other cases to do so would mean costly rebuilding, far beyond the limits of the average remodeling budget.

Fig. 259 shows a section of a house in which bearing partitions HA , AB , and BC help support the first, second, and attic floors. Bearing partition AB , for example, supports one end of the joists extending from D to B and from E to B . If this partition is removed in remodeling, then a beam must be put at B , running the same direction as the old partition, to support bearing partition BC . In like

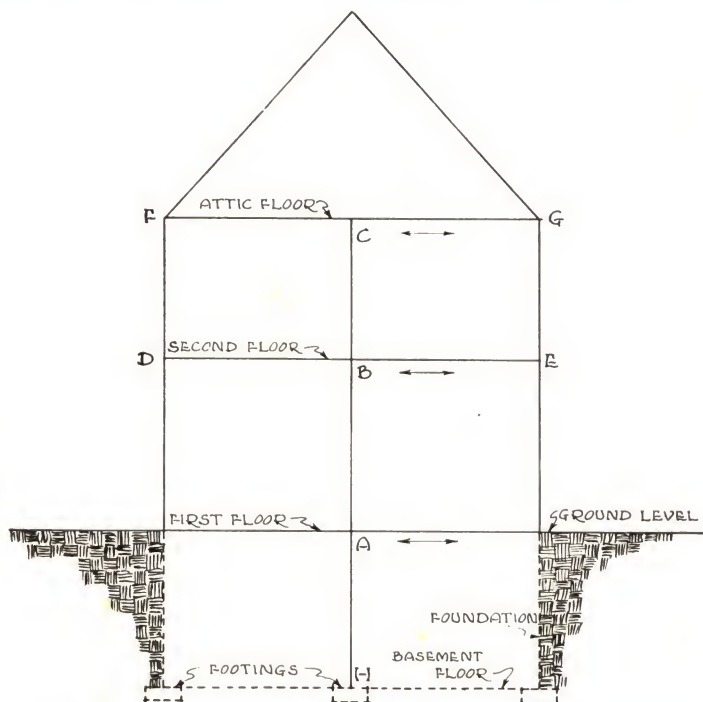


Fig. 259. How Bearing Partitions AB and BC Help Support First and Second Floors. Joists Run in Direction of Arrows and Extend from D to B and from B to E .

manner, if bearing partition HA , or columns used instead of a bearing partition, are removed, then a beam must be put at A to support bearing partitions AB and BC .

If a beam is put at B , in place of bearing partition AB , then the second-floor bearing partition BC , regardless of second-floor remodeling, should remain directly over the beam at B . If bearing partition BC must also be moved, then another beam must be used at C to support the ends of joists running from F to C and from C to G .

However, a beam at *C* would not be recommended, in view of structural difficulties and cost.

JOIST DIRECTIONS. In some cases the floor joists in old houses do not all run in the same direction. This might cause trouble where a room was being made larger by combining smaller rooms, because all flooring, except diagonal rough flooring, must run at right angles to the joists in order to give the floor the necessary strength. It would hardly be economical to remove old joists and replace them in different directions, except in special and rarely-encountered situations. Therefore, before room remodeling is planned, determine the joist directions in your house.

The exception to the foregoing rule is where wood blocks, cork tiles, and similar materials are to be used as finish flooring. In such cases one or two layers of diagonal rough flooring serve as a base, and this can be applied over the joists no matter which way they extend.

JOIST STRENGTH. In all room remodeling, the size, length, and spacing of joists should be determined and the tributary load calculated, as explained in Chapter VII. Then, if you find that the old joists are not strong enough you can add new ones as required, between the old ones. Bridging also adds to the strength of floor framing.

CONSERVATIVE PLANNING. In remodeling rooms, it is well to be rather conservative, so that the results will please many people and be adapted to many ways of living. This is especially true if you are remodeling a house for sale or for rent. An eccentric effect, though it might satisfy your family perfectly, is a poor investment in that it tends to lessen the resale value of a house. As a general rule, rooms should be planned so that ordinary rugs and furniture will not look out of place in them.

HIGH CEILINGS. Many old houses have high ceilings which, though not in keeping with modern design, cannot be structurally changed. The appearance of height can be reduced by running a wall molding around the room, from 12 to 18 inches below the ceiling.

ENLARGED EFFECTS IN ROOMS. Small rooms may be given an enlarged effect by generous use of glass in windows and mirrors. Large-scale windows do much to make a room seem larger, particularly when the view is pleasing. Large mirrors over fireplaces or entire mirror walls add to the illusion of size in a pleasant manner. Glass manufacturers will be glad to supply data free of charge.

ARCHES. Openings (without doors) between rooms, or between rooms and hallways, can be improved by removing the wood trim, or casing, around them and applying plaster or whatever finish material is being used. The tops of such openings can be made elliptical. The resulting archways are pleasing, and contribute much toward a modern effect. When plaster is used as the finish, metal corner beads should be nailed to the edges all the way around the opening, before the plaster is applied.

For such arches, you can obtain ready-made elliptical tops in various widths.

PIPES. In remodeling rooms, you must investigate the possibility of encountering service pipes in walls whose removal is planned. If there are pipes in such walls, a satisfactory and economical means of placing them elsewhere must be determined before you can assume that your proposed remodeling can be carried through.

CONDENSATION ON PIPES. Cold-water pipes and even soil pipes, if in a horizontal position, will sometimes "sweat" during hot and humid weather. This is due to condensation of the moisture in humid air as it comes into contact with the cold surface of the pipes. All such pipes which run in a horizontal position between floors, or below the ceilings of basement recreation rooms, should be insulated, using a form of insulation made especially for that purpose. Insulation which prevents the "sweating" and dripping of water from such pipes will safeguard ceilings, walls, and floors against dampness, staining, and discoloration.

SHAPE OF ROOMS. Living rooms, bedrooms, and recreation rooms serve their purpose best when they are rectangular in shape. Kitchens, dining rooms, dressing rooms, dens, and bathrooms can be more nearly square without detracting from their usefulness.

In remodeling, especially in the true Colonial and Cape Cod types of houses, the shape of rooms will be governed to some extent by the characteristic architectural design, as well as by window and door location requirements. In houses where the type of architecture is carried out more in feeling than in exact detail, the shape of rooms can be determined with less restrictions. It is good practice, however, to consider the general architectural type, and plan the remodeling of rooms to follow that type as closely as possible, since the external appearance of a remodeled house is perhaps as important as its interior.

The exception to this rule is if you are planning a modernistic house. Here, as previously explained in Chapter I, the interior is of first consideration.

ORIENTATION. The direction in which a house faces, the direction of the prevailing winds, the position of the house in relation to the street and to the outlook, and the positions of neighboring houses must all be considered carefully in remodeling any room to good advantage.

Facing Direction. In relation to sunshine and prevailing winds, the direction in which a house faces is an important consideration. The living room and dining room should be located so as to receive the most sunshine and air, together with an outlook as pleasant as possible. This may have considerable bearing on the shape of the room, aside from all other necessary considerations.

For bedrooms, also, sunshine and the prevailing winds are matters of importance. Sunshine is cheerful and pleasant, and exposure to prevailing winds is important for comfort during the warmer weather. Recreation rooms require light and air, also, and for the same reasons.

Location of Street. You may not want the principal windows of certain rooms to open on the street side of the house. The side or rear lawns may provide a better outlook, as well as greater privacy. When remodeling your rooms you should take advantage of the most attractive outlook.

Neighboring Houses. If your neighbor's house is very near, the maintaining of privacy must enter into consideration. The shape of rooms, and especially the location of windows, should be planned to foster as much privacy as possible. One way you can accomplish this is to avoid placing windows directly in line with the windows in the adjoining house.

TILE SIZES. If you are using wood, cork, insulation, or other types of tile on floors and walls, it is wise to use the smaller patterns in small rooms, and the larger patterns in larger rooms.

SLOPING CEILINGS AND DORMERS. In remodeling attic space into bedrooms or recreation rooms, or in remodeling a house to conform, for example, to the Cape Cod type of architecture, it often is necessary to use sloping ceilings and dormers for the rooms on the second floor.

As an illustration of sloping ceilings, study *X* in Fig. 260. The line *AD* represents the attic floor and the lines *AM* and *DM* the roof. The side walls, *GE* and *HF*, must be what are called *dwarf* walls. These should be at least 4'6" high. The ceiling, which is represented by the line *BC*, has to be high enough to allow good head room, or at least 7'6" high. At that height, however, it will not completely cover the new rooms, and part of the roof, lines *EB* and *FC*, must be used as ceiling. These are called *sloping* ceilings.

Y in Fig. 260 represents the use of dormers. The triangular area *AEB* is designed to allow light and air to enter the rooms through

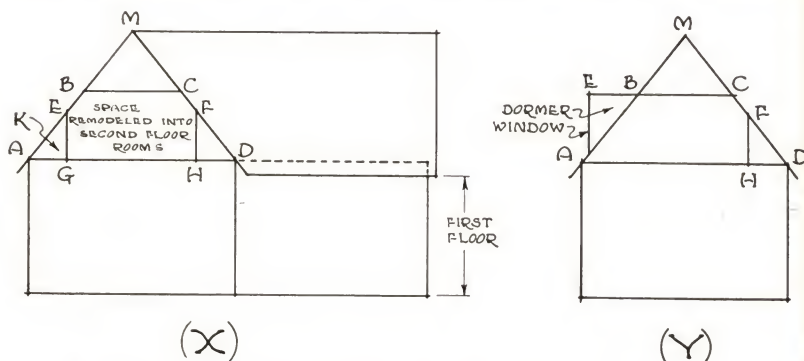


Fig. 260. Details of Walls and Ceilings in Attic Room with and without Dormers

windows. You will find examples of similar dormers, and other styles of them as well, in Chapter I.

Even if they are of the recommended height, however, the ceilings in attics will seem low. To offset this impression, plan to use tile, wallpaper, or other finish material in a way that will emphasize the vertical meeting lines, or vertical stripes in the wallpaper design.

CHIMNEYS. New chimneys, like new stairways, are costly to construct. Wherever possible, therefore, leave the old ones in place, even at the expense of some awkward corners in the remodeled rooms.

Of course, if a fireplace is one of your objectives in remodeling, a new chimney will have to be considered. It then will be a factor in both your first- and second-floor plans, because a chimney takes up considerable space, especially where more than one flue is necessary.

Old chimneys can be enlarged with less expense, but the area added must also be taken into consideration in room planning. The

blueprints in the back of the book present an example of chimney enlargement.

HEATING DUCTS AND PIPES. If you plan to move one or more partitions in order to enlarge or alter rooms, consideration should be given to the fact that heating ducts and pipes must be run through walls or partitions from the basement to the second or third floor, as explained in Chapter XIII. Before planning any room remodeling, therefore, check to determine whether it will be possible to run the necessary ducts and pipes through the proposed walls. If you are planning complete remodeling, such a check may not be possible until your remodeled floor plans are laid out.

Note: The considerations pointed out in the foregoing pages, and the various items of design which follow, are what might be called the *ideal*. In other words they are principles of design which you should *try* to follow. However, there are few instances, in remodeling, where such ideal design can be achieved, because of conditions in the existing houses which cannot be changed or which it would cost too much to overcome. All you can do, then, is to follow ideal design procedure as closely as possible. In Chapters IV, V, XV, and XVI you will notice many examples where ideal design has not been possible, and where compromises have been made.

PLAN FOR REMAINDER OF THIS CHAPTER AND FOR CHAPTER XVI

This Chapter. The remainder of Chapter XV is devoted, first, to explaining many items of design involved in the remodeling of individual rooms and, second, to illustrative examples.

Chapter XVI. In Chapter XVI the rooms remodeled in this section of Chapter XV are laid out as an example of floor plan remodeling, and the floor plans are in turn employed in an illustration of elevation remodeling.

The same house is used in both chapters, so that you may follow the entire procedure of remodeling.

Neither kitchens nor bathrooms are taken up in detail, because the remodeling of these rooms was discussed in previous chapters.

Many items must be considered partially in this chapter and finally in Chapter XVI, because the remodeling of rooms, floor plans, and elevations, in actual practice, are all carried on at the same time. So far as possible, however, the procedures are considered in two separate chapters, to make it easier for you to read and study them.

ROOMS AND THEIR DESIGN

LIVING ROOMS. The living rooms of old houses, which years ago were called "parlors" or "sitting rooms," as a usual thing are too small for modern living. In addition, they are burdened with much dust-catching "gingerbread" decoration, are poorly lighted and ven-

tilated, ill adapted to the arrangement of modern furniture, and thus are unsuited to present-day living and entertaining. In years gone by, the parlor was used only for formal occasions; between such events it was tightly closed. Today living rooms serve as the family gathering place, and there are few hours of the day or evening in which they are not in use.

A few of the principles most often applied in remodeling old living rooms are outlined in the following paragraphs.

Furniture. As explained in a previous chapter, the furniture of the living room is the important thing; the four walls are simply the enclosure for it.

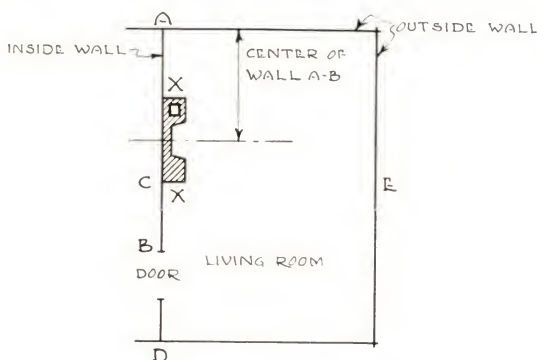


Fig. 261. Locating a Fireplace

This enclosure must be of a size and shape in which the furniture can be arranged to pleasing advantage. In accordance with suggestions given in Chapter IV, therefore, cutouts or templets, drawn accurately to scale, should be made for every piece of furniture that is to go in the remodeled room. These can be placed in various groupings, as an aid in determining the required shape and size of the room.

Activities. The activities in a living room include quiet reading, conversation, musicals, games, dancing—in other words, family life in hours of relaxation. So far as possible, the room should be planned with these activities in mind.

Reading calls for enough comfortable chairs and attendant lamps or lamp tables for the entire family; for conversation, some chairs need to be placed rather close together; musicals require the piano with ample space around it for additional instruments, as well

as for the participants; games require tables, which may be portable, and room to place chairs around them. Dancing requires a space which can be cleared of furniture.

Fireplaces. Fireplaces should be centered as nearly as possible on the wall of which they are a part, and they should be as far away from doors as can be arranged. Fig. 261 shows a typical living room where the fireplace is located on the center line of interior wall *AB*. This is the ideal location, since it allows for furniture to be grouped around the fireplace without interference because of the door. If the fireplace had been placed on the center, *C*, of the wall *AD*, it would

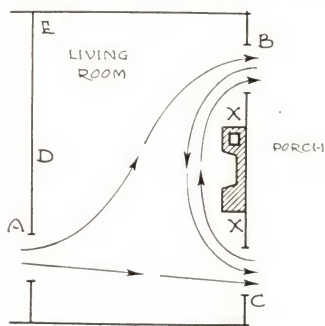


Fig. 262. Undesirable Location of Doors with Reference to Traffic Through Living Room

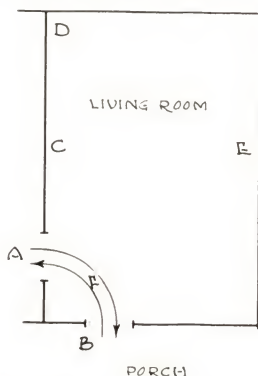


Fig. 263. Recommended Location of Doors to Regulate Traffic Through Living Room

have been too near the door to permit attractive grouping of the furniture about it.

Another advantage of this arrangement is that it affords a degree of privacy to the people grouped around the fireplace, as compared with a location, say, at *E*, where they would be observed by anyone passing the door.

Traffic. A living room should be designed so that there is the least possible traffic through it. Study Fig. 262. Here, with doors at *A*, *B*, and *C*, the traffic would be as shown by the arrows. Such traffic tends to disrupt the furniture arrangement around the fireplace and indeed the whole arrangement of the room. If the three doors are unavoidable, the fireplace would be better placed at *D* or *E*.

Fig. 263 shows an ideal traffic arrangement. Here the fireplace might be located at *C* or *D*, or if necessary at *E*.

Waste Space. If fireplaces stand out from the walls to any degree, there are waste spaces as indicated by X in Figs. 261 and 262. Such spaces are often utilized for cupboards or bookshelves.

Entrances to Living Rooms. The entrance areas, as shown at F in Fig. 263, should be free of built-in equipment, and even of furniture. It should be possible to enter deeply into a room before encountering obstacles to free and easy progress.

Clear Area. If a living room can be large enough and of the right shape to leave the center of the room clear of furniture, an impression of space is created which adds to the charm of the room.



Fig. 264A. Typical living and Dining Room Before Modernizing
Courtesy of U.S. Gypsum Company, Chicago, Ill.

Windows. Windows, as many as can be placed without violating the architectural type or leaving too little wall space, will add to the cheerfulness and charm of a living room. Large full-length (ceiling to floor) windows, commonly called picture windows, are especially desirable if the view is attractive. The sills of ordinary windows should be below eye level for people who are seated in the room.

Modernizing Living Rooms. Old living rooms that are not being completely remodeled can be improved greatly by modernizing the trim, walls, floor and other details. Note Fig. 264A. In such a living room the following improvements can be made without great cost:

1. Remove old colonnade, pedestals, and trim from around the opening into the dining room.

2. Substitute a plastered arch.
3. Remove old picture molding.
4. Apply new finish to walls.
5. Put in new floors.
6. Put in new and modern baseboards.
7. Put in new living room light fixture and convenience outlets.
8. Install modern trim around windows and door.
9. Install modern windows and doors.

In Fig. 264B you can see illustrations of the improvements that were made.



Fig. 264B. Living and Dining Rooms After Remodeling
Courtesy of U. S. Gypsum Company, Chicago, Ill.

Miscellaneous. Rectangular shaped living rooms, in sizes 11x17 (minimum), 12x18, 13x24 and 16x30 are recommended. Plan such rooms so that standard sized rugs can be used attractively. Powder rooms, which were explained elsewhere, should be as near as possible to the main living room door.

DINING ROOMS. Dining rooms have changed from the gloomy, formal rooms of bygone years to informal sunny places where families and friends enjoy food and companionship.

There are two schools of thought regarding the modern dining area. Some designers and families prefer separate rooms, while others think that an open area added to a living room is modern and ample. In remodeling work the open area, or dining alcove, usually is easier

to plan, but the decision as to which is preferred must rest with the owner, or with the lady of the house.

Location. For better kitchen efficiency, in relation to Center *III* described in Chapter XII, the dining room should have a common partition with the kitchen, yet it should not be far from the living room. In ideal planning the dining room or alcove is so placed that guests in the living room do not see the preparations for serving.

If this room can be located so as to afford a pleasant view, sunlight, and air, its charm will be increased many times over. Ample windows help to make the room a cheerful place, and a mirror or two will add to the impression of size.

Furniture. Ordinarily dining room furniture consists of a table—round or oval, square or oblong—a buffet or sideboard or built-in cupboards, portable servers, and chairs. A built-in cupboard is shown in Fig. 264B. All of this furniture varies in size and, just as in the living room, the size of the room will conform to some extent to the size requirements of the contemplated furniture. Cutouts or templets can be used to excellent advantage in this planning, also.

Wall Surfaces. At least two walls of a dining room should be as nearly unbroken by windows and doors as possible, to provide space for buffet, cupboards, server, and chairs.

Traffic. There is little traffic in a dining room except for entering and leaving it before and after meals, and the serving of the meals. However, a minimum of 3'0" clearance all the way around the table should be provided for purposes of serving, moving chairs out from the table, and pushing servers around.

Millwork. China cabinets built into corners or along the walls, and used for the display of dishes and nicknacks, add a definite charm to a dining room. A great variety of such cabinets and cupboards are available and can be used to advantage, especially in smaller dining rooms or dining alcoves where there is not enough room for a buffet.

Separate Rooms. In Fig. 265 a portion of a first-floor plan for a typical house shows a separate dining room. Notice that some of the features of ideal design suggested for the dining room could not be followed in this case. For one thing, every wall is broken; and for another, the room is visible from the living room. However, this is a typical remodeling job, in which ideal planning often cannot be followed in all details. There is ample room for table and chairs, and for

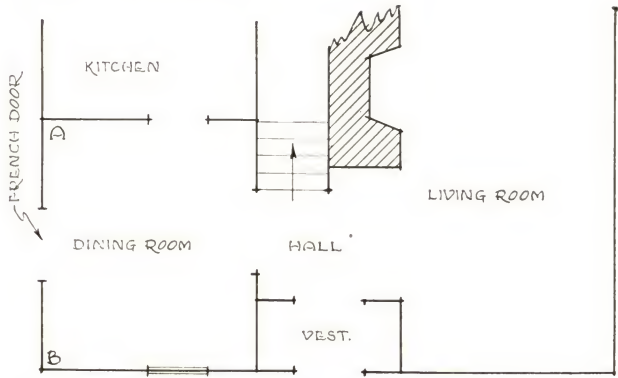


Fig. 265. Typical Separate Dining Room

built-in cabinets at A and B. The French door provides light and air, as well as an attractive view of the lawn. The room is next to the kitchen and not too far from the living room.

Dining Alcove. Fig. 266 illustrates part of a first-floor plan where a dining alcove takes the place of a separate room. The alcove actually is part of the living room, and shares a view of the fireplace and the rear garden through windows at C. The unbroken wall, AB, could be used for a buffet. The space is handy to the kitchen and does not require a large area, since a table could be extended out into the living room, if required.

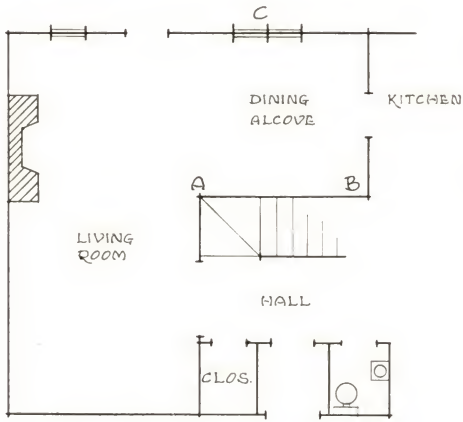


Fig. 266. Typical Living Room with Dining Alcove

Miscellaneous. Plan dining rooms so standard sized rugs can be used effectively. Think over the whole remodeling problem, to see which type of dining space best suits the conditions. Recommended sizes for separate rooms are 12x15, 13x16, 12x14 and 10x10. For alcoves the recommended sizes are 6x9, 7x10, and 8x10.

BEDROOMS. In planning for the modern bedroom, there is an increasing tendency to make them smaller, and to limit the amount of furniture in them to essentials such as beds, occasional tables, a chest of drawers, and a chair or two. The use of dressing rooms is

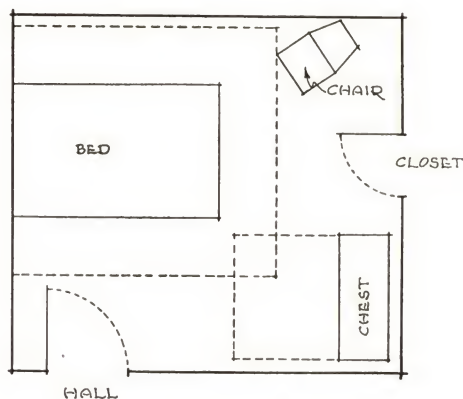


Fig. 267. Minimum Sized Bedroom

partly responsible for this tendency. Small bedrooms are, of course, easier to keep clean, in addition to using less floor space.

Minimum Size Bedroom. Fig. 267 illustrates a conventional minimum sized bedroom, containing a bed, a chair, and a chest of drawers. The dotted lines represent space required for ease in "making" the bed, opening doors, and pulling out the drawers of the chest. Bedroom planning, also, should be carried on with the aid of cutouts or templates representing the furniture and determining the space required around or in front of each piece of it.

Clearance around a bed should be from 1 to 2 feet, and in front of a chest there should be at least twice the thickness of the chest. Other pieces of furniture can be judged in proportion.

Bedrooms without Dressing Rooms. Fig. 268 illustrates a typical layout of bedrooms in a remodeled house where no dressing rooms

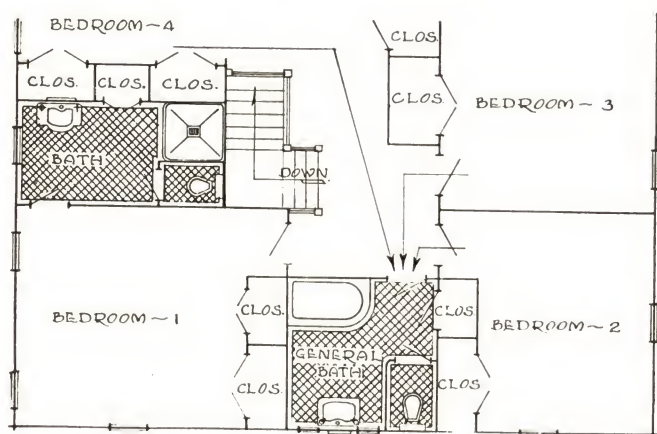


Fig. 268. Typical Bedrooms without Dressing Rooms

were provided. Notice that three of the rooms, 2, 3, and 4, use the general bathroom, while bedroom 1 has a separate bath.

Bedrooms with Dressing Rooms. The bedroom in Fig. 269 has a combination bathroom and dressing room, an excellent layout. Such arrangements often can be planned, in remodeling, by reducing the size of the larger bedrooms and using the space for bathroom and dressing room.

Fig. 270 shows a dressing room conveniently located in relation to bedroom, bathroom, and hall. Notice how the wall areas have been used for closet space. The closets at *A* are for clothing, while *B* and

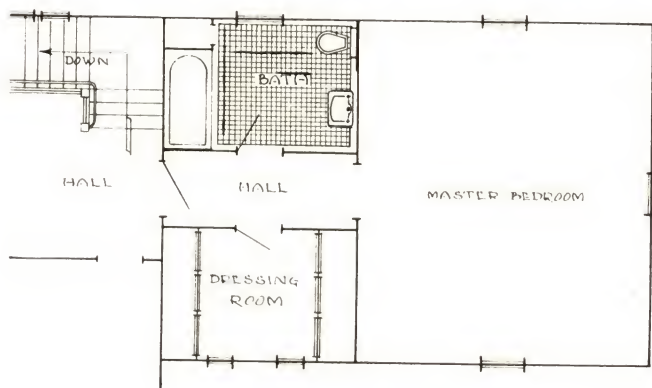


Fig. 269. Typical Bedrooms with Dressing Rooms

C are storage closets. Also note the dressing table between the windows, and the full-length mirror on the opposite door.

Privacy. Each bedroom should have all possible privacy and should be entered from a hall. The door should be hung so that it can be partly open without much of the room being visible from the hall.

Miscellaneous. Every bedroom should have windows on at least two sides, for good ventilation. Recommended room sizes are 10x12 and 12x14 feet for rooms using twin beds, and 8x9 or 9x12 feet for rooms with one bed only. Sufficient ventilation should be possible without drafts across the beds. This is a matter requiring careful

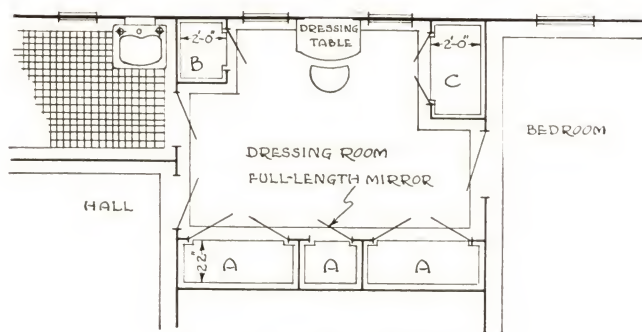


Fig. 270. Typical Dressing Room

planning. Other desirable features are mirrors, good light, and a pleasing outlook.

LAUNDRIES. The laundries in most old houses consisted of tubs, a gas burner or small stove, and a washing machine. This equipment was housed anywhere in the basement, depending on where the burner or stove happened to be installed. Such laundries are inefficient, hard to keep clean, and depressing to work in. Modern laundries are designed somewhat like modern kitchens, for efficient functioning. They save steps, can be kept immaculate, and are pleasant places in which to work.

Basement Laundries. A modern laundry, built in an old basement, could afford all of these advantages:

Sizes. To be efficient, clean, and step-saving, a laundry should be 6x8, 8x12, or at most 12x14 feet in dimension. These recommended sizes will permit efficient grouping of appliances to provide work centers somewhat corresponding to those outlined for kitchens.

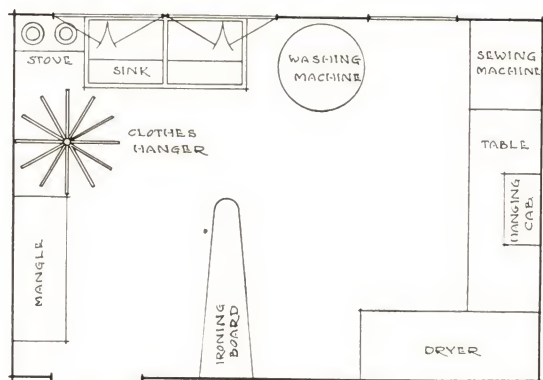


Fig. 271. Typical Layout for Basement Laundry

Windows. Because most basements are below ground level, the windows used to be small; often not more than 12 inches high and 24 to 36 inches wide. As a result, basements were poorly lighted and poorly ventilated.

By the use of areaways, good sized double-hung windows may now be substituted, and these supply sufficient light and ventilation. A basement laundry should have at least one such window; two would be better.

Typical Layout. Fig. 271 shows a layout for a modern basement laundry. The appliances shown are typical. Note that the planning provides for work centers so that the work may be routed. This efficient and step-saving layout can be planned by the use of templates, as explained for kitchens in Chapter XII. The floor may be of painted concrete, or linoleum; the walls may be of plaster, or one of many kinds of tile. A floor drain should be provided.

First-Floor Laundries. Some housewives prefer the laundry to be on the first floor near the kitchen. Fig. 272 shows an old and inefficient

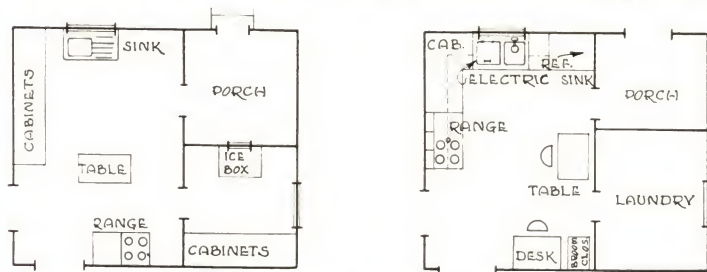


Fig. 272. Left, Old Kitchen. Right, Remodeled to Make Space for Laundry

kitchen remodeled to include a first-floor laundry. The equipment for this first-floor laundry could be like that shown in Fig. 271.

RECREATION ROOMS. For an example of what can be done with old basement and attic areas in terms of play or recreation rooms, turn to Figs. 75A, 75B, 76A, and 76B of Chapter IV. The cost of such remodeling is not high, and it adds to any house a very worth-while area for children's play, for games, hobbies, or entertaining. Fig. 273



Fig. 273. Children's Playroom Converted from Attic Space
Courtesy of U. S. Gypsum Company, Chicago, Ill.

shows an attic space that has been remodeled to make an ideal playroom for children.

Basement Rooms. When planning to create a recreation room in the basement, there are a few items which should be considered and for which provision should be made.

Dampness. If a basement has never been damp, there is probably no cause for concern. However, if dampness does or is likely to occur, one or more of the following procedures should be considered:

1. Placing drain tile around foundation or footing.
2. Applying damp proofing in the form of cement mortar and asphalt to outside surface of foundation.

3. Using insulation, applied to furring strips, as plaster base or finish.

Windows. For recreation rooms, ample window area is a requirement. Areaways are often used to accomplish this, as explained for laundries. In rooms of rectangular shape, there should be one or two good sized windows at each end, and if possible, one or more along one side. If areaways are impossible for some reason, small basement windows can be made to appear larger as shown in Fig. 274.

Girders. Girders may be used to replace old columns, in recreation areas, as shown in the blueprints in the back of the book.

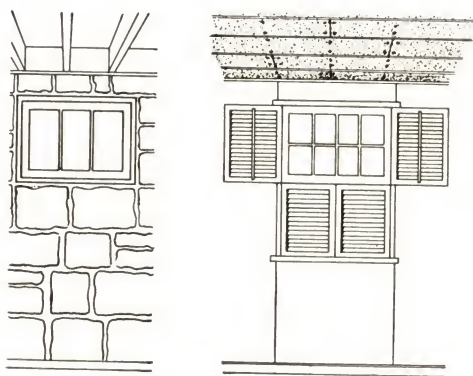


Fig. 274. Left, Small Cellar Window. Right, Same Space Made to Appear Larger by Use of Mullioned Glass, and Window Frame with Half-Blinds

Attic Rooms. When attics are being remodeled into recreation rooms, the roof areas must be thoroughly insulated. Otherwise the rooms would be too hot to use during the summer months.

Miscellaneous. The size of recreation rooms is governed, first, by the available space in the basement or the attic. The second consideration is the contemplated furniture, game tables, or other equipment. Billiard or Ping-pong tables in themselves require considerable floor area, plus the free space around them for movement of the players. Templets can be used to good advantage here, since it would be a waste of money to build a room larger than necessary. If possible, the millwork should be the same as in other parts of the house. A half bathroom and at least one closet are desirable features of such rooms. Fireplaces add charm, but unfortunately they also add cost.

The walls can be given one of the following treatments:

1. Put a smooth coat of cement mortar on foundations.
2. Use any one of several available materials on interior partitions. (See Chapter X.)

3. Plaster all walls. Lathing must be furred on foundations.

Ceilings can be treated with plaster or insulation materials.

The floors can be wood over concrete, linoleum over wood or concrete, or painted concrete.

CLOSETS. One of the chief inconveniences found in the older houses is the shortage of closet space. In remodeling, therefore, the problem of closet space should be given full consideration.

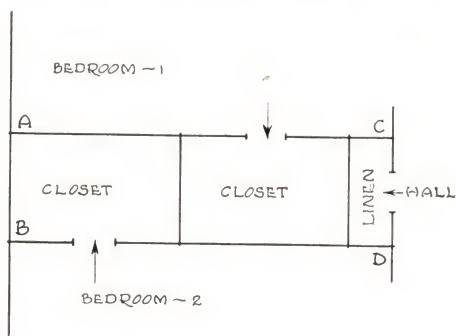


Fig. 275. Planning Closets by Reducing Size of Large Bedrooms

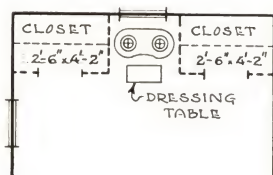


Fig. 276. Closets Built within Bedrooms

Kinds of Closets. Closets are essential for the following rooms and purposes:

Kitchen—storage of cleaning appliances

Baths—towels and like items

Living room—coats

Recreation rooms—toys, game tables and equipment

Bedrooms—wearing apparel

Halls—linens

Where Closets Can Be Planned. *Bedrooms.* One easy way to provide bedroom closets is to take some of the space from a large bedroom and divide it so as to make closets for two bedrooms. This plan is shown in Fig. 275, where the area ABCD was originally a part of either bedroom 1, or bedroom 2. Another way of providing closets is shown by the dotted lines in Fig. 276.

Fig. 277 shows some of the spaces which can be utilized to advantage for closet or storage space, where houses are being remodeled along Colonial or Cape Cod lines.

Other Closets. Corners or ends of bathrooms, kitchens, or halls that are larger than necessary can be partitioned off to make closets. Study the various remodeled floor plans, with the closet spaces they provide, in Chapters IV, V, XVI and XVII.

Closet Design. The over-all size of closets, of course, depends on the space available for them. However, no matter what their size,

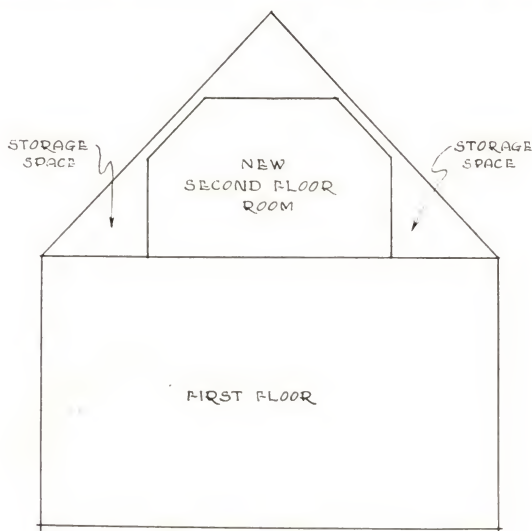


Fig. 277. Storage Space in Colonial and Cape Cod Houses

care should be given to their design in order to provide proper storage of the maximum amount of material.

Design of Bedroom Closets. Bedroom closets should be designed so that there is a place for every article of clothing. Fig. 278 shows two excellent examples.

HALLS. Halls are a necessary means of access to various rooms, especially to bedrooms, where privacy is of importance. They must be considered in detail, when remodeled floor plans are being assembled, as explained in the next chapter.

Not over 10 per cent of the floor space of a house should be devoted to halls. The halls should be at least 3'0" wide, to facilitate

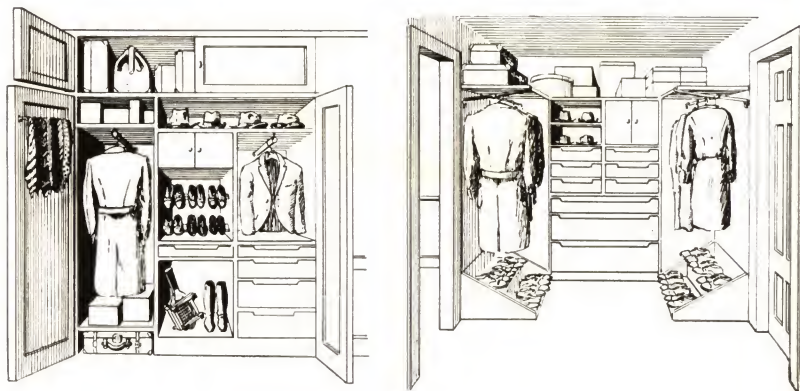


Fig. 278. Two Well-Designed Closets

the moving of furniture, as well as to provide ample passage space. Provision should be made for good lighting, either natural or artificial.

REMODELING TYPICAL ROOMS

TYPICAL PROBLEMS.* For the sake of illustrative explanations, the following typical problem is stated:

Figs. 279, 280, and 281 show floor plans and a picture of a typical old frame house which was designed and built long before modern bathrooms and kitchens, or automobiles, were common. (The floor plans shown in Figs. 279 and 280 are rough representations of the first- and second-floor plans shown in Fig. 73B.) Structurally the

*The problem stated applies to room remodeling in this chapter, and to floor plan and elevation remodeling in Chapter XVI.

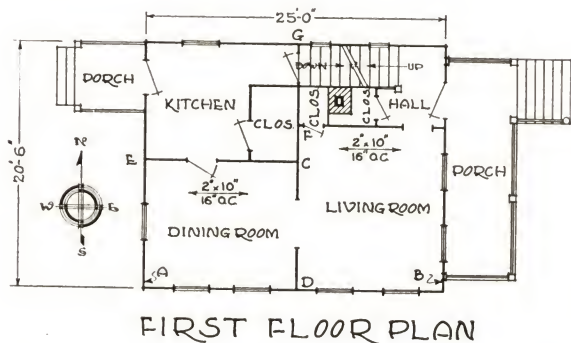


Fig. 279. Plan for First Floor of Old House. Joists Run East and West and Are Ample in Strength. DG Is Bearing Partition

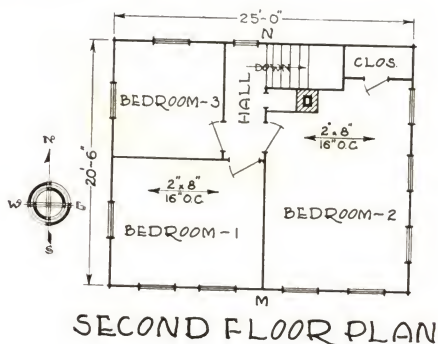


Fig. 280. Plan for Second Floor of Old House. Joists Run East and West. Partition MN Is Directly Over DG of Fig. 279

house is in good shape. However, besides the lack of bathroom and garage, the rooms are too small, their arrangement is inefficient, and the finish and treatment are old fashioned. There is no central heating and no plumbing.

The owner, after careful preliminary thinking as outlined in Chapter IV, decided to remodel the house completely, to make it modern, efficient, and charming.

The following were the remodeling requirements:



Fig. 281. Exterior View of House. Left Side Faces South

1. Change the front entrance from the east to the south side.
2. Remove old porch.
3. Build a garage near northwest corner of the house.
4. Build a new porch between the garage and the house.
5. Replace old siding and shingles with modern materials.
6. Retain old window locations, but add new frames, sash and divided lights.
7. Add modern front entrance and shutters.
8. Greatly enlarge the living room, and locate it on the south side of the house.
9. Make a bedroom in northeast corner of first floor.
10. Install bathrooms on both first and second floors.
11. Build new and modern kitchen in northwest corner, with door to new porch.
12. Plan a dining alcove.
13. Add fireplace to living room.
14. Retain old closet near old front entrance.
15. Have a hall between living room and bedroom.
16. Have two bedrooms, plus ample closet and storage space, on second floor.
17. Create recreation room in the basement.
18. Create laundry room in the basement.
19. Retain existing stairs.

REMODELING LIVING ROOM. The first planning relative to the living room must consider furniture and activities.

Note: This planning is carried on by the use of cutouts or templets representing the furniture, as previously explained in Chapters IV and XII. For our typical problem it is assumed that the contemplated furniture, consisting of day-enport, chairs, tables, coffee table, a desk, and floor and table lamps, will require a large living room. We assume further that the owner likes to entertain, and this also calls for a large room. The room must be large enough, also, to provide for the dining alcove, given as one of the requirements.

The living room shown in Fig. 279 is not large enough and does not face in the desired direction. Therefore it is necessary to plan a new room.

From preliminary thinking as to the first-floor requirements it is evident that the house will have to be made larger. The addition, we assumed, is to be put on the rear (north) side.

The width of the old house is 25'0". Deducting $6'' + 6'' = 12''$ for the two outside walls, leaves 24'0" clear space from *A* to *B* in Fig. 279. Twenty-four feet is a good living room length, where a large room is required, so it is assumed that the old partition, *CD*, between living room and dining room will be torn out.

When this bearing partition is removed, a beam must be placed at the second floor, to replace it (see Chapter VII), because it supported the joists in the second floor and the partition between old bedrooms 1 and 2, shown in Fig. 280. This is similar to removing bearing partition *AB* in Fig. 259.

With the partition *CD* in Fig. 279 removed, the space occupied by the old living and dining rooms is ell shaped, as shown by shading at *A* in Fig. 282. This not being a desirable shape, the partitions *CE* and *CF*, in Fig. 279, could be removed, making possible a living room of the size and shape shown by shading at

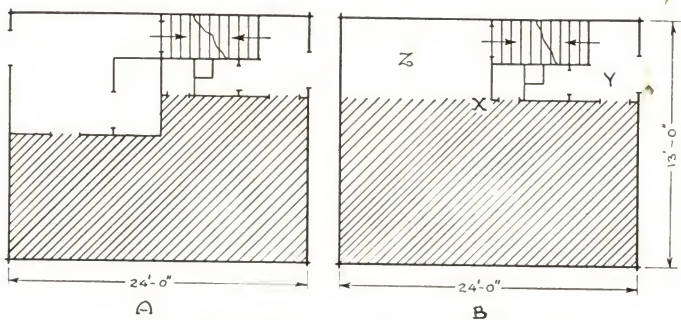


Fig. 282. Development of New Living Room

B in Fig. 282. This is a desirable shape and size, and we will tentatively assume it to be satisfactory. Whether or not it will work out, actually, we will learn when the first-floor plans are assembled, in Chapter XVI.

Removing section *CF* of the old bearing partition necessitates the extension of the new beam from the south outside wall to point *F* or further. This will be checked when the floor plans are laid out.

Windows. The remodeling requirements specify that all old window openings are to be used. Therefore no window planning is necessary, except the exchange of position of the door on the east and a window on the south. This will be shown in Chapter XVI.

Traffic. The new front entrance will enter directly into the living room, and traffic will have to cross the room, probably in two directions. This is not ideal design, but cannot be avoided in this instance.

Fireplace. There is only one logical place for the fireplace, and that is about at *X* in Fig. 282. To locate it anywhere else would mean taking out one or more windows, also the chimney would not look well on the outside, as we can visualize by examining Fig. 281. The chimney location, as it concerns the floor plan, must be checked when the plans are laid out, in Chapter XVI.

NEW KITCHEN. Following procedures explained in Chapter XII, a new kitchen, small and efficient, can be planned as part of the addition to the north

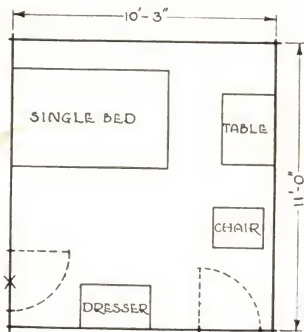


Fig. 283. Tentative Plan of First-Floor Bedroom

side of the house. Assume that it is tentatively planned to be about 8x12 or 7x11 in size. Requirements call for a door leading out to the new porch, and there must be a door leading to the interior of the house. Therefore the kitchen will be of the U type.

FIRST-FLOOR BEDROOM. This room will also be part of the rear addition. It probably will be used as a maid's room, and should contain a single bed, a dresser or chest of drawers, a chair, and perhaps a small table.

This room should parallel the new kitchen in the 11' or 12' dimension. A tentative layout for such a bedroom is shown in Fig. 283. Assume that one door will be at X. Size and shape will be checked when the first-floor layout is made.

FIRST-FLOOR BATHROOM. The first-floor bathroom, since it will be used by the maid as well as by members of the family, should be near both the bedroom and the kitchen. The room need not be large; 5x8 feet will accommodate tub, water closet, and lavatory. The layout can be designed tentatively, as explained in Chapter XI. The assumed size of 5x8 will be checked when the floor layout is made.

PORCH. Porches range from 9x9 to 9½x9½ or larger. This porch is to connect the garage and the house; 9 or 10 feet square would be ample size.

GARAGE. A two-car garage is not much more expensive than one housing a single car. Most families can use the space for yard and garden tools or equipment, if they do not have a second car. The length of a garage should be at least 18 feet; 19 would be better. A 17-foot width is ample for two cars. The garage is tentatively planned, therefore, 17x19 feet.

DUCTS AND PIPES. The partitions to be used for the new ducts and pipes cannot be determined until after the floor plans have been laid out, in Chapter XVI.

HALLS. There will have to be a hall around point Y, in B section of Fig. 282, and probably another one around bathroom and kitchen. These will have to be worked out when the floor plans are being made.

DINING ALCOVE. In B of Fig. 282 there is an area marked Z, which has possibilities for use as the dining room alcove, since it will be near the kitchen which has been planned for the northwest corner, and since it also connects with the living room.

The size and shape, roughly determined by the use of templates, we assume to be 7x9 feet.

Windows. New windows must be planned for this alcove. For the sake of good light and a cheerful atmosphere, two or three are necessary.

SECOND-FLOOR BEDROOMS. In planning the second-floor bedrooms, the following items must be considered:

1. The second floor will have to be the same width as the first floor, or 25'0".
2. At least two bedrooms are required, together with a bathroom and ample closet and storage space.
3. The second-floor window locations are not to be changed.
4. The bedrooms should be at the south end of the floor plan.
5. The old roof is not to be disturbed any more than necessary. Thus the area added to the rear of the house will not be full height, at second-floor level, because of the slope of the roof. Closets and storage space, therefore, should be placed at the north end of the floor plan.
6. Since the stairs are not to be disturbed, they must be placed in exactly the same location as in the old plans.

7. Because the closets will be at the north end of the floor plan, the bedroom doors must be placed in or near their north walls, depending on the location of the hall.

8. A hall must connect the stairway with the bedrooms and the bathroom.

9. If the bedrooms are to be at the south end of the floor plan, the bathroom must be north of them. It cannot be on the east side of the plan, because of the stair well. It should have a full ceiling height, so in all probability one bedroom will have to be made smaller than the other, to leave room for it.

10. The kitchen is to be in the northwest corner of the first floor, so if possible the bathroom should be above it, to economize on piping.

In the second-floor rooms, the considerations of size and shape must be thought of before the furniture. The reason for this is evident.

As shown on the old plans, the width, east and west, of the house is 25'0" from outside to outside, or 24'0" inside. This width can be divided in half, allow-

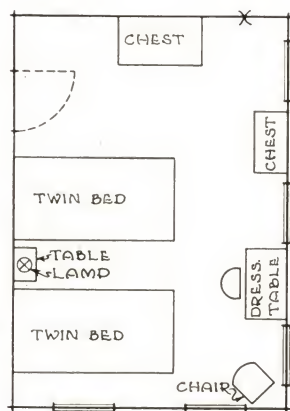


Fig. 284. Typical Bedroom Layout for Twin Beds in Room Measuring Approximately 11'6" x 16'0"

ing about 12'0" for each bedroom, minus the width of the partition between them.

The north and south over-all dimension of the old house is shown on the old plans as 20'6".

One of the recommended sizes for double bedrooms is 12x14 feet. One recommended size for single rooms is 9x12 feet.

Assuming that the stair well requires about 4'0", one bedroom can be about 16'0", north and south (plus an unknown amount to be determined after chimney and stair well are located), and say 11'6", east and west. The other bedroom cannot be that long because of the space, say about 6'0", required for the bathroom. Its size, therefore, would be about 10'0", north and south, and 12'0", east and west. These dimensions are not far from the recommended sizes and will keep the bedrooms and bathroom within the old dimensions of the house, where the ceiling is full height. Also the old bearing partition can remain in place, where it will be directly over the beam installed to replace the old bearing partition removed to enlarge the living room. This is similar to bearing partition *BC* in Fig. 259.

Now that the approximate sizes of the rooms have been determined, the furniture can be considered. We assume that in the larger of the two bedrooms twin beds will be used, in addition to two chests, a dressing table and chair, and a bedroom chair. For the smaller room, requirements might be a double bed, a bureau, chest, and bedroom chair. Both rooms would also need small tables for lamps.

Fig. 284 shows a layout of the larger room with the windows located about as they exist in the old house, a door near the north end, and wall space at X for a closet door. The specified furniture fits well into this space.

Fig. 285 shows the layout of the smaller room, with the existing windows, the entrance door from the hall, and the closet door at X. The required furniture fits nicely here, also.

SECOND-FLOOR BATHROOM. From a study of the old plans we see that the top of the stairs is at about the center line of the house at the north wall. A hall at least 3'0" wide must connect with the stairs. Therefore the space left for the bathroom is about 8 or 9 feet. When planning the smaller bedroom a distance

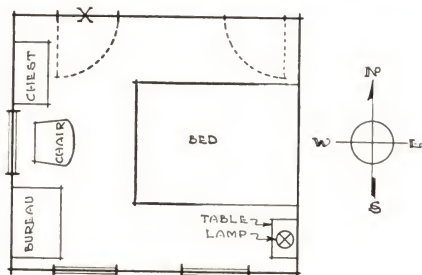


Fig. 285. Typical Layout for 10' x 12' Bedroom with Double Bed

of 6'0" was left for the bathroom, so its size will probably be around 6x8 or 6x9 feet. The layout of the room can be designed as explained in Chapter XI.

HALLS. The halls cannot be planned until floor plan layouts are drawn.

CLOSETS. On the first floor an addition of about 11'0" was planned for the north side of the house. However, the sloping roof makes part of the corresponding second-floor area an odd shape. Closets can best be planned, therefore, when the remodeled floor plan is laid out.

CHIMNEY. The chimney will require floor space, but the exact location cannot be determined until both floor plans are drawn.

LAUNDRY AND RECREATION ROOM. The planning for these two rooms is simple, and therefore not given specific attention here. The blueprints in the back of the book give excellent examples of remodeling to create these rooms. Bearing partitions or columns are considered as explained for HA in Fig. 259.

MISCELLANEOUS ROOMS. Dens or seclusion rooms, nurseries, music rooms, or rooms for any other special purpose can be planned in the same manner as the more common rooms considered in the foregoing pages.

You have now learned how to plan the remodeling of individual rooms. In the following chapter the thinking and planning involved in remodeling floor plans and elevations are explained.

CHAPTER XVI

Floor Plans and Elevations for Remodeling

EVEN a casual study of old houses, particularly those built thirty or more years ago, will reveal several interesting facts which emphasize the sharp contrast between past and present ways of thinking and living as embodied in the homes of each era.

In those turn-of-the-century days, the size of a man's house was thought to determine his business reputation. Therefore men built great barn-like structures, containing a "bragabout" number of rooms, and so heavily ornamented that they resembled fancy old-style gingerbread. Such houses were designed to make an imposing impression, rather than to promote efficiency or comfort.

Other men of that time, being unable to afford such lavish monuments, built much smaller homes, containing just enough rooms for their needs. These more modest houses had little ornamentation and less proportion; box-like, they were for the most part ugly and depressing.

One redeeming feature of both the ornate and the plain houses of that time is that in most cases they were built solidly of good materials and by craftsmen who, although without our modern knowledge of efficient design, took pride in doing their work well. This is the fact that makes the remodeling and modernizing of such old houses economical, sound, and satisfying.

In Chapters XI, XII, and XV the basic principles, together with considerations of miscellaneous details involved in the remodeling of rooms, were explained and illustrated by typical examples. In this chapter, basic considerations and details involved in making floor plans and elevations for remodeling are explained by a continuation of the typical example set



forth in Chapter XV and illustrated by Figs. 279, 280, and 281 in that chapter.

MISCELLANEOUS CONSIDERATIONS

Several items, concerning floor plans and elevations for remodeling, should be understood before any planning is begun. A sound comprehension of these considerations will save you time and money, and will tend to make your planning easier and the final results more gratifying. You will find some of these considerations outlined, illustrated, and explained in the following pages.

STRUCTURAL ECONOMY. In the interest of economy, as much as possible of the structural framing of well-built old houses should be retained. An occasional window, door, or partition may be eliminated, altered, or enlarged without undue cost, but in general the framing for walls, roofs, floors, and like structural details cannot be changed appreciably without excessive cost. If the budget for remodeling your house is limited, this consideration is doubly important because the less structural change, the more modernizing can be accomplished within the allowable costs.

Windows and Doors. Fortunately most old houses were so designed that the windows were in good balance (windows on second floor directly over those on first floor). This makes for a saving in labor and materials because often they can be left as they were originally built. An illustration of this is found in the house considered in this chapter.

In isolated cases, and one such is shown by the blueprints in the back of the book, extensive relocating of windows is unavoidable if good remodeling results are to be obtained.

Changes in exterior doors are expensive to make, and should be avoided as far as possible. Interior doors can be relocated inexpensively, especially if the finish is some material other than plaster.

Partitions. Nonbearing partitions can be removed with little expense and need cause no concern. Bearing partitions, as previously explained, require expensive substitutions if they are removed. An example is found in succeeding pages where a beam has to be employed in place of the dining room-living room bearing partition.

Walls. Changes in outside walls involve a considerable amount of labor and material, which increases the costs. Such changes require

work on foundations, sills, plates, studs, floors, cornices, lathing, and plaster. They should be avoided, therefore, in all cases where acceptable compromises in design can be made.

Floors. Changing floors may include working on plates, studs, joists, beams, and both rough and finish flooring material, if joists are not strong enough for new floor loadings brought about through the remodeling process.

Roofs. To rebuild a roof is very expensive. It means tearing out and rebuilding cornices, rafters, roof boards, roofing, gutters, flashing, attic-floor joists, and other possible details. It is good policy, therefore, to disturb old roofs as little as possible. Adding on a portion, building in dormers, and applying new roofing material are not so expensive. Such procedures are involved in many remodeling jobs.

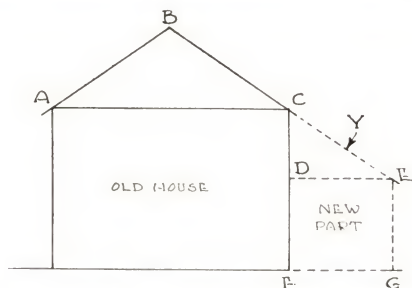


Fig. 286. Economical Method of Roof Addition to Old House

It is possible to carry on rather extensive remodeling with comparatively little changing of the old roof. For example, notice Fig. 286. Here the solid lines AB and BC represent the old roof on a two-story house. The dotted lines $DEFG$ represent an addition to the first floor. The dotted line CE shows how the old roof, BC , can be extended to include the addition to the first floor in an economical manner. This plan has the added advantage that space CDE can be used for closets and storage space in planning the second-floor rooms.

If additions are of such a nature that the principle of Fig. 286 cannot be used, the new portion of the roof should be constructed at the same pitch as the old. An example of this is the roof over the porch and garage shown in Figs. 74A and 74B of Chapter IV.

When dormers are to be built, two or more old rafters should be removed to make room for the dormer framework. This does not

disturb the structural unity of the old roof to any extent. The major share of the cost is in the dormers themselves, and this is in line with the principle of remodeling design which recommends that most of the cost allowed be used for modern additions, and little for rebuilding the old parts of the house.

Chimneys. It has already been explained that building an entirely new chimney adds greatly to remodeling costs and that wherever possible the existing chimney, possibly with an addition to it, should be used. Unfortunately, however, chimneys in many old houses are small and unsuited for use with modern heating equipment or with fireplaces, for the following reasons:

1. They are built of only one course (layer) of brick, without flue lining, and are therefore fire hazards.
2. The flues are too small to carry the volume of smoke and gases, which, for safety, needs to be removed.
3. The chimneys are not high enough to provide the required draft.
4. Usually they have only one flue, whereas separate flues are required for fireplace and furnace.
5. Sometimes they are situated with their tops below the highest line of the roof, so that they are affected by overdrafts from the roof and do not draw well.
6. The lack of sufficient footing areas under the chimneys permits settlement and cracking.
7. There is no insulation between chimney and wood structural parts. This constitutes a serious fire hazard.

If new chimneys are required, the following considerations should be kept in mind:

***Shapes of Flues.** Round flues are most efficient because they offer less resistance to the smoke and gases, which ascend spirally. Because of space allotted to chimneys, however, it is often necessary to use rectangular flues which, if of sufficient size, will function satisfactorily.

Sizes of Flues. Flues should be designed in sizes which will accommodate the use of coal as fuel. It would be a mistake to design flues for only gas or oil, because, if a change to coal were ever necessary, the chimney might have to be rebuilt.

In selecting the flue for a furnace or other heating appliance, a round flue with a diameter of 10 inches or a rectangular flue 8 by 12 inches are the minimum sizes recommended for chimneys over 35 feet high. For chimneys less than 35 feet

*Courtesy of National Coal Association, Chicago, Illinois

high, a round flue should have a minimum diameter of 12 inches and a rectangular flue should not be smaller than 12 by 12 inches.

For fireplace flues the same minimum specifications should be observed.

If flues are too small, improper draft will result. This becomes a perpetual annoyance.

Flue Lining. There are many suitable materials for use as flue linings, which can be purchased ready to install. Such materials should be able to withstand high temperatures and they should have a minimum thickness of $\frac{5}{8}$ inch. Linings should be set in cement mortar making sure that all joints are struck smooth on the inside. Each length of flue lining should be placed in position and the firebrick laid around it. This method is better than slipping the lining down after several courses of brick have been laid, because in the latter case the joints cannot be properly filled with mortar, and leakage is sure to occur.

Height of Chimneys. The minimum recommended height, above grate level, is 35 feet. Higher chimneys are even better. The higher the chimney, the stronger the draft. For one-story houses, where 35-foot heights are not possible, the chimney should extend at least three feet above flat roofs and two feet above the ridge of peak roofs.

Location of Chimneys. The best location for a chimney is near the center of a house where cold winds cannot chill it and cause it to draw poorly. When chimneys must be placed on outside walls the exposed wall of the chimney should be at least eight inches thick.

Footings. Special care should be taken to assure ample footings under chimneys. Footings should extend at least 12 inches beyond the chimney all around, should be made of reinforced concrete, and should be at least 12 inches thick. This will prevent settlement, with consequent cracking, fire hazard, and damage to walls and ceilings of the house.

Insulation. Wherever a chimney comes nearly in contact with wood structural members there should be at least two inches of fireproof insulation between the chimney and the wood.

Mortar. Cement mortar is recommended for the entire chimney construction.

Flashing. Where chimneys pass through roofs, provision should be made for expansion and slight movements due to high winds. Copper flashings are recommended for this purpose.

Fireplaces. Throats and other important parts of fireplaces can be purchased ready to install. If you contact manufacturers of fireplace equipment, you can obtain their specifications for fireplace construction, recommended sizes, and like details.

TYPE OF ARCHITECTURE. The plan of remodeling which calls for a house to be changed completely to another type of architecture is the most costly, and for that reason not always popular. Where cost allowances are limited, partial remodeling is often decided upon. In such cases, few expensive exterior changes are made. Much improvement can be brought about, as explained in a previous chapter, by creating the *feeling* of some particular type of architecture. Note, in Chapter V, Figs. 83A and 83B and 84A and 84B, together with

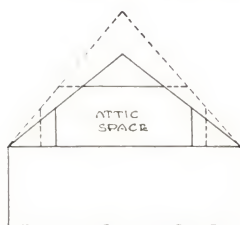


Fig. 287. Roof Pitches

Figs. 73A and 74A, and 78A and 78B in Chapter IV. The exteriors of the houses shown in these illustrations have all been improved to the point where they embody the *feeling*, or effect, of the Colonial or other types of architecture.

Typical ways in which such improvements can be made are discussed in succeeding pages.

ROOF PLANNING. When planning new roofs, the pitch or slant is important and must be considered carefully in order to give the house, or addition, a pleasing proportion, as well as providing the maximum amount of room if attic bedrooms or other attic rooms are desired.

Pitch. The pitch of a roof, or the degree of its slope, cannot be stated as a fixed rule, because it varies with the height, width, and

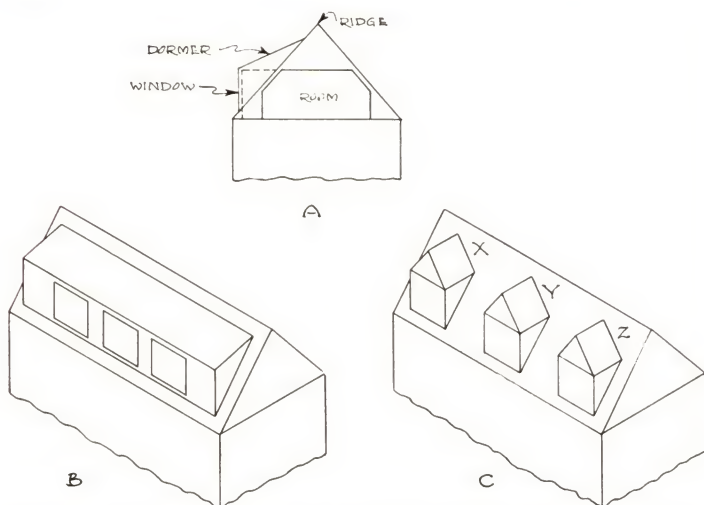


Fig. 288. Dormers. A, Attic Room; B, Continuous Dormer; C, Individual Dormers

design of the individual house. The best way to select pitch is to draw varying degrees of slope and select the one which looks most attractive. To aid in this selection, study the roof pitches of existing modern houses.

Attic Space. The pitch of a roof determines to some extent the sizes of the rooms which can be planned under a roof. See Fig. 287. The solid lines show the extent of the attic space with a low-pitched roof whereas the dotted lines show the increased amount of space obtainable if the ridge is made higher.

Dormers. Attic rooms should be provided with dormers to admit light and air. There are two types of dormers generally used for this purpose. At *A* in Fig. 288 is a section showing an attic room with a dormer. The dotted lines indicate the added room obtained if a continuous dormer, such as shown at *B*, is used. If individual dormers are used, like those shown at *C*, there is little increase in usable space.

In using the type of dormer shown at *B*, care should be taken to see that the dormer is subordinate to the main mass of the building. In other words, if dormers are made too large they dominate the whole house and make it appear out of proportion. Trial drawings will aid in obtaining satisfactory results.

DUCTS AND PIPES. The heating and plumbing pipes, necessary in any modern house, must be considered and provided for in the floor plans to be used in remodeling.

Ducts. The ducts used with hot-air heating systems must go through partitions from the basement (where most furnaces are located) to second- and third-floor rooms. These ducts are rectangular in shape and generally about $3\frac{1}{2}$ by 12 or 14 inches in dimension. The space between studs in partitions is 3 to $3\frac{5}{8}$ by 14 inches in size. Therefore no ducts larger than $3\frac{1}{2}$ by 14 inches can be used.

Fig. 289 shows two typical ways in which ducts are run from basements to second-floor grilles. The dotted lines and the letter *C* indicate the ducts.

The left side of the figure shows an ideal situation where the second-floor partition is directly over the first-floor partition, and the duct runs vertically the entire distance.

On the right side of the figure, the second-floor partition is not directly over the first-floor partition, and the duct must be run between joists for the distance shown by dimension *A*. This situation is

not objectionable for mechanical furnaces, but it is not a good practice where gravity furnaces are employed.

In the basement the ducts can run between joists, as at *B*, or under them, as at *D*. Basement ceilings can be furred down to hide all ducts, especially in recreation rooms. This procedure is indicated by the blueprints in the back of the book.

Pipes. Plumbing and hot-water pipes and steam or vapor heating pipes must also be run in partitions and between joists.

Some of the plumbing pipes, such as the soil stacks, are 4" in

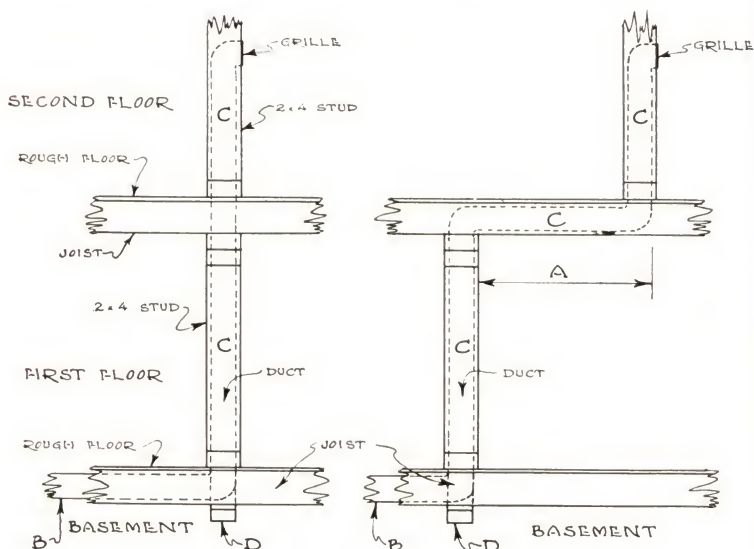


Fig. 289. Ducts in Partitions

diameter and have bell-shaped connections, or hubs, which are almost 6" in diameter. These pipes require an 8" partition in order to prevent the joints from extending beyond the plaster surface. Most other pipes are smaller than 4" in diameter, and can be run without trouble in any partition.

HALLS AND CLOSETS. Both halls and closets must be provided for as the floor plans are being developed. The rooms are drawn partially complete, then spaces for halls or closets are determined before the final shape and size of the rooms can be decided. Often a compromise must be effected whereby the ideal shapes of rooms are sacrificed in order to provide minimum hall or closet space. This is

justifiable, for halls are necessary for privacy, and no home can be called modern unless it has ample closet space.

CHIMNEY SPACE. Chimneys must extend from the basement out through the roof, and unfortunately they require a considerable amount of space. Therefore, it is wise to think about the chimney before the rooms, halls, or closets are drawn. Once the approximate position and space required have been determined, other details can be planned around the chimney space.

STAIRS. Like chimneys, stairs must be planned for prior to drawing the plan of the rooms. If the old stairs are to remain in place, their location, of course, is already decided. New stairs may require the making of many rough sketches before a suitable location is determined.

Stairs going from first to second floor should be located centrally, so that at both floors access to the stairs is easy and convenient. The top of the stairs must lead into a hall, which in turn leads to all second-floor rooms. This requires careful thinking and planning.

An ideal situation is for chimney and stairs to be close together, with the halls planned around them.

BASEMENT ENTRANCE. A basement entrance is a convenience and, unless gas or oil is used for heating, is a necessity, for providing a way to carry ashes out without taking them through the house.

PLANS AND ELEVATIONS. Floor plans, although they are drawn first, must be planned with the elevations in mind at all times, especially when planning considerable change in architectural type, or extensive additions. The location of doors and windows, for example, must be planned not only in reference to the interior; their appearance in the elevations must be considered as well. This procedure is not difficult if rough single-line sketches are drawn from time to time during the planning. The exterior appearance must be visualized as the floor plans are developed.

In some cases, the elevations can be drawn after the floor plans have been partially thought out. Or, floor plans and elevations can be developed more or less at the same time, creating an interior as well as an exterior picture as the planning progresses. In actual practice, many trials are often necessary. You may be surprised, however, to discover that following this procedure is a fascinating experience with each new trial bringing about an improvement and lending interest to

the next step. Even the most experienced planners must develop their plans in this same way.

In this chapter the floor plans are developed without the preliminary trials, because such a procedure is less difficult for you to follow, and requires less explanation and illustration. However, once you start planning your own work, you will readily adopt the recommended sketch method. You must do so, if you want to obtain the most satisfactory results.

FINAL DRAWINGS. Keep in mind that the drawings and written specifications must show or explain every item required, and that estimates of cost are based entirely on plans and specifications. Adding items after construction has begun is costly and likely to cause unforeseen difficulties. For this reason, make every effort to see that the final drawings are accurate and complete in all details. Check them with each and every notation which you made during your preliminary thinking.

FLOOR PLANS FOR REMODELING

Before you proceed to a study of the explanations and illustrations relative to floor plans in remodeling, the following facts should be understood.

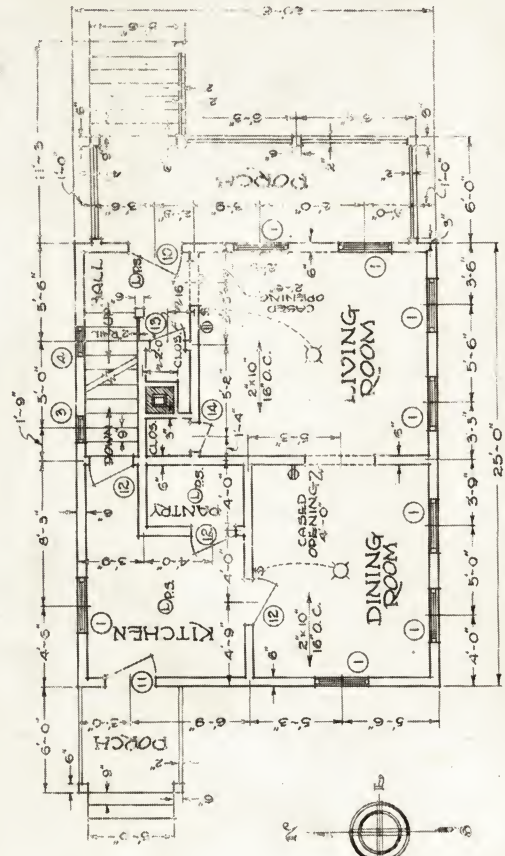
1. The principles of drawing explained in Chapter VI are followed with but few deviations, and these are for the purpose of making the explanations and illustrations easier to visualize and understand.
2. The floor plans developed are for the house which you studied in Chapter XV, and which was shown in Figs. 279 and 280.
3. The remodeled rooms planned in Chapter XV are used as a basis for the floor plan remodeling in this chapter.
4. The floor plans are developed in a step-by-step method, to make the explanations and illustrations easier to visualize and understand.

In the development of the remodeled first-floor plan, for example, the first step is the preparation of the original floor plans. This is done as explained in Chapter VI; an illustration is presented which shows that plan.

In the second step, assume that a piece of tracing paper has been placed over the drawing of the old floor plan (first step) and

WINDOW SCHEDULE	
①	DOUBLE HUNG 3'-0" x 5'-2" - 2 LTS.
②	DOUBLE HUNG 2'-0" x 5'-2" - 2 LTS.
③	DOUBLE HUNG 1'-6" x 3'-10" - 2 LTS.
④	DOUBLE HUNG 1'-8" x 5'-10" - 2 LTS.
⑤	
⑥	

DOOR SCHEDULE	
⑩	3'-0" x 7'-0"
⑪	2'-10" x 6'-8"
⑫	2'-6" x 6'-8"
⑬	2'-0" x 6'-6"
⑭	1'-8" x 3'-8"
⑮	
⑯	



SCALE IN FEET
 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

FIRST FLOOR PLAN

Fig. 290. Step 1. Old Plan for First Floor

that the first phase of the remodeling is drawn. In the drawing for the second step, visualize the gray lines as representing the lines of the old floor plan showing through the tracing paper which was placed over it. The black lines represent the first phase of the remodeling. These were drawn in accordance with Chapter VI.

The third step, shown by a third illustration, indicates the next phase of the remodeling drawing. The gray and the black lines have the same meaning which we have just stated.

The remaining steps are carried on in like manner.

In actual practice all steps of the remodeling plan would be drawn on a single sheet of tracing paper, which had been placed over the plans for the old house. Here, separate drawings for each step are shown in order to indicate more clearly the various steps in the process of developing the floor plan drawings for remodeling.

FIRST-FLOOR REMODELING

The following explanations are presented in the form of an illustrative example, including applications of the principles studied in all preceding chapters. The drawings are vitally important and should be studied with the most painstaking care.

FIRST STEP. See Fig. 290. This shows the first-floor plan for the old house which is to be remodeled. The drawing is made accurately to scale, in accordance with procedures explained in Chapter VI. It shows the rooms, porches, walls and partitions, stairs, chimney, doors and windows, symbols, dimensions, and such fixtures as existed in the old house. It will aid in the planning for remodeling, because the bearing partitions, joist sizes and directions, and other important structural considerations that previously have been explained, are all shown.

Fig. 290 as shown in the book does not scale according to the $\frac{1}{4}'' = 1'0''$ scale to which it was originally drawn. The reason for this is that the original drawing had to be reduced in size in order to fit on a page. To scale this, and the drawings for other steps, an additional scaling process is necessary.

Note the "reduced scale" shown in the lower left-hand corner. To scale a desired distance, in Fig. 290, spread a pair of draftsman's dividers across the dis-

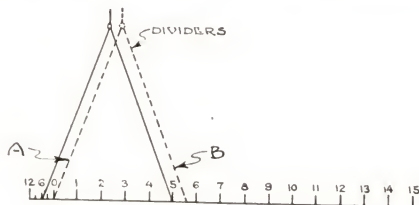


Fig. 291. Using a Reduced Scale

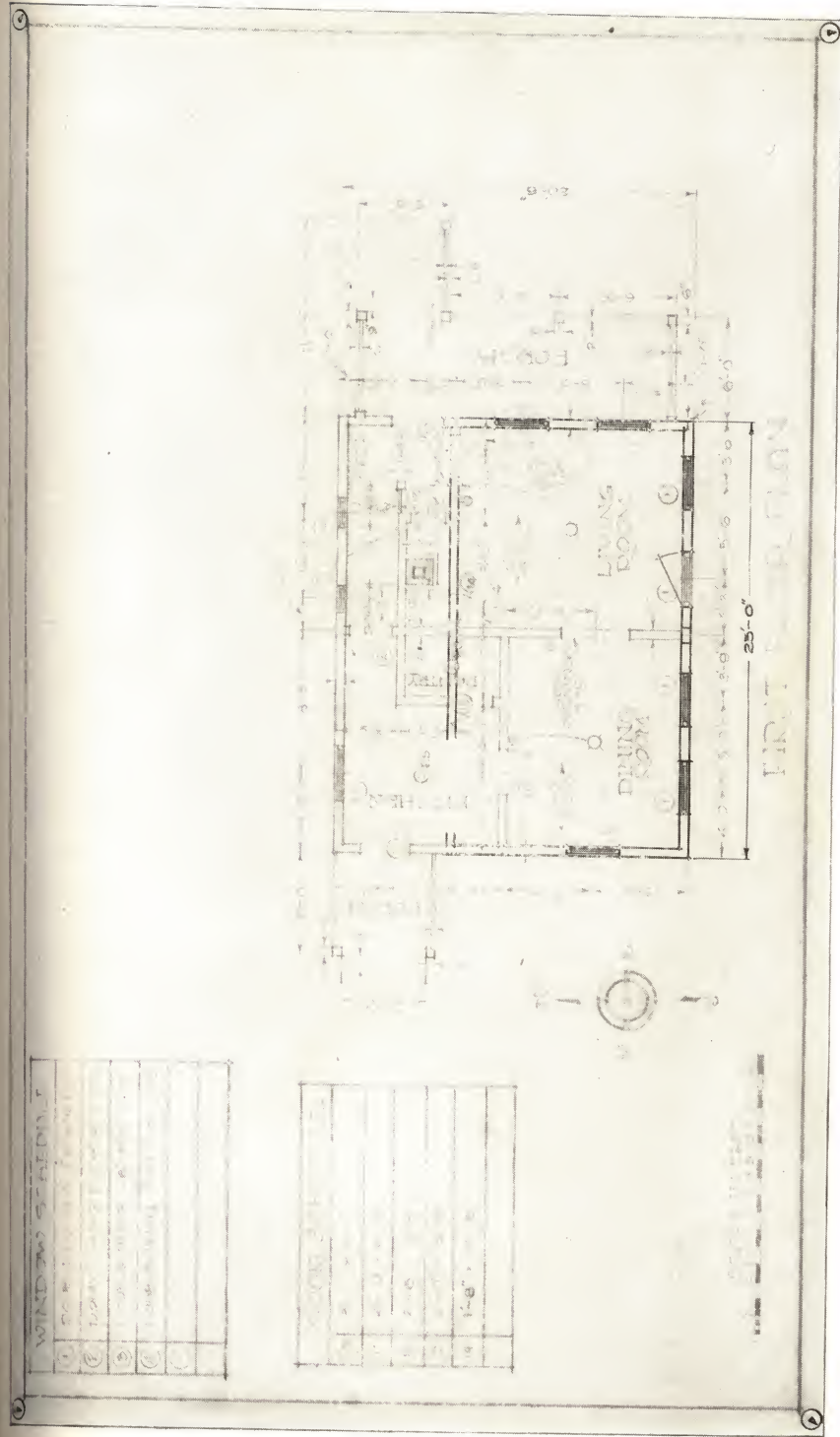


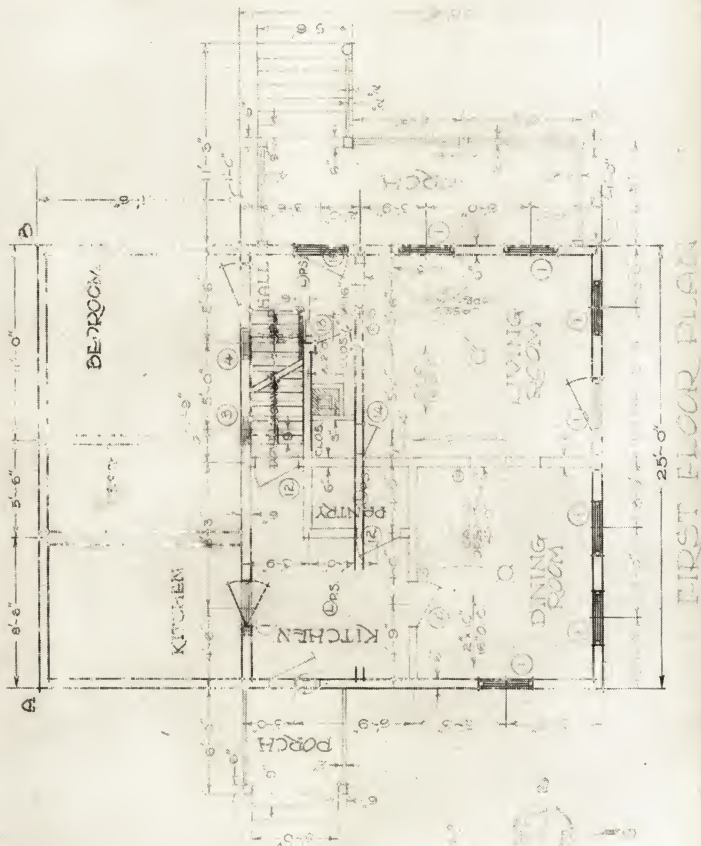
Fig. 292. Step 2 in Drawing Remodeling Plans for First Floor

WINDOW SCHEDULE

①	DOUBLE HUNG	3'-0" x 5'-2" LITS
②	DOUBLE HUNG	2'-0" x 5'-2" LITS
③	DOUBLE HUNG	1'-6" x 5'-0" LITS
④	DOUBLE HUNG	1'-5" x 5'-0" LITS
⑤		

DOOR SCHEDULE

①	3'-0" x 7'-0"
②	2'-0" x 6'-8"
③	2'-6" x 6'-8"
④	7'-0" x 6'-5"
⑤	1'-5" x 6'-5"



FIRST FLOOR PLAN

tance to be scaled. Then, without changing the spread, pick the dividers up and put one point at *O* on the reduced scale and see where the other point comes along the scale. Suppose the result is as shown by the dotted line dividers in Fig. 291. The distance is something over 5'0". Pick up the dividers again and put point *B* at 5. Then point *A* will land somewhere between 0 and 12, where the number of inches can be read. The solid line dividers indicate a distance of 5'6" which is the length of the distance being scaled.

SECOND STEP. See Fig. 292. Here, assume that a piece of tracing paper has been put over the drawing for the first step. The thumb tack and border lines are shown to make the drawing look as it would in actual practice.

This step concerns the portion of the floor plan where the remodeled living room is to be located.

In planning the remodeling of rooms in Chapter XV we decided that the living room should be about 24'0" long and 13'0" wide. It was reasoned that if the partition between the old living room and dining room and the partition between the old dining room and kitchen were removed, there would be ample space for the required living room.

Drawing Living Room. In Fig. 292 the east, south, and west walls of the new living room are drawn right over the original outside wall, as it shows through the tracing paper, and are represented by the black lines. Also part of the north wall is drawn in just to show the approximate northern boundary of the room. This wall cannot be finished in this step because the other rooms and the halls have not been located.

Door. Since the south side of the house is to be the new front, the door is moved from the east side and located in place of one of the windows. From the outside, the door would look better in the middle of the elevation, but to do that would mean relocating all of the windows, which must be avoided. The door, then, for the time being will be left as shown.

Windows. All west, east, and south windows, excepting the one to be moved to the old door location, are drawn right over the old ones because no new window locations are contemplated in these areas. For this reason it is not necessary to consider how the windows will appear from the exterior.

Note: Remember that the gray lines shown in Fig. 292 are the lines of the old first-floor drawing showing through the tracing paper.

THIRD STEP. See Fig. 293. This figure must be thought of as the same drawing as Fig. 292; separate drawings are used in this chapter, only to show you the additions made as the planning progresses.

North Wall. Part of what was the old north wall of the house can be drawn now. This should be drawn lightly because parts of it will have to be erased.

Stairs. The stairs going up are to be moved from the old location, so they can be drawn in. Those going down may have to be moved a short distance also, but old basement stairs were so constructed that they can be moved, as a unit, to the position desired.

Closest Door. The closet door, near the old front entrance can be drawn next but the closet cannot be drawn because the new chimney has not been planned.

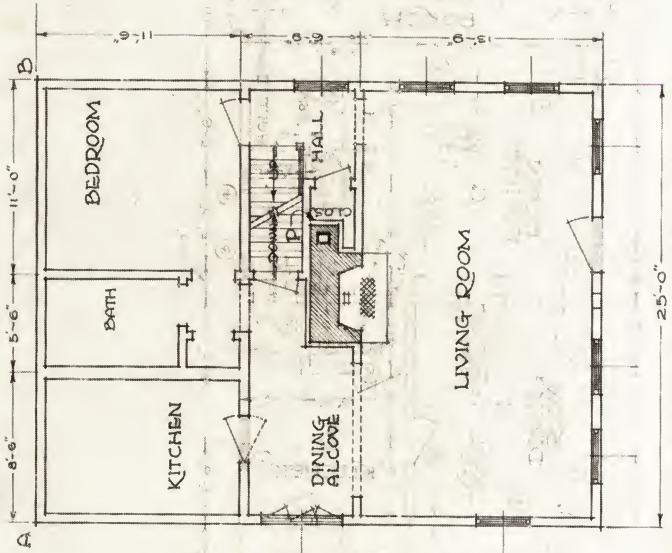
New North Wall. In Chapter XV we decided that the addition was to be put on the north side of the house and was to have an inside dimension of 11'0". Therefore, the new north wall can be drawn 11'6" beyond the old north wall. This is the wall between *A* and *B*.

WINDOW SCHEDULE

①	DOUBLE HUNG	5'-0" x 7'-0" x 2'-0"
②	DOUBLE HUNG	6'-0" x 8'-0" x 2'-0"
③	DOUBLE HUNG	6'-0" x 10'-0" x 2'-0"
④	DOUBLE HUNG	6'-0" x 12'-0" x 2'-0"
⑤		
⑥		

DOOR SCHEDULE

①		
②		
③		
④		
⑤		
⑥		



FIRST FLOOR PLAN

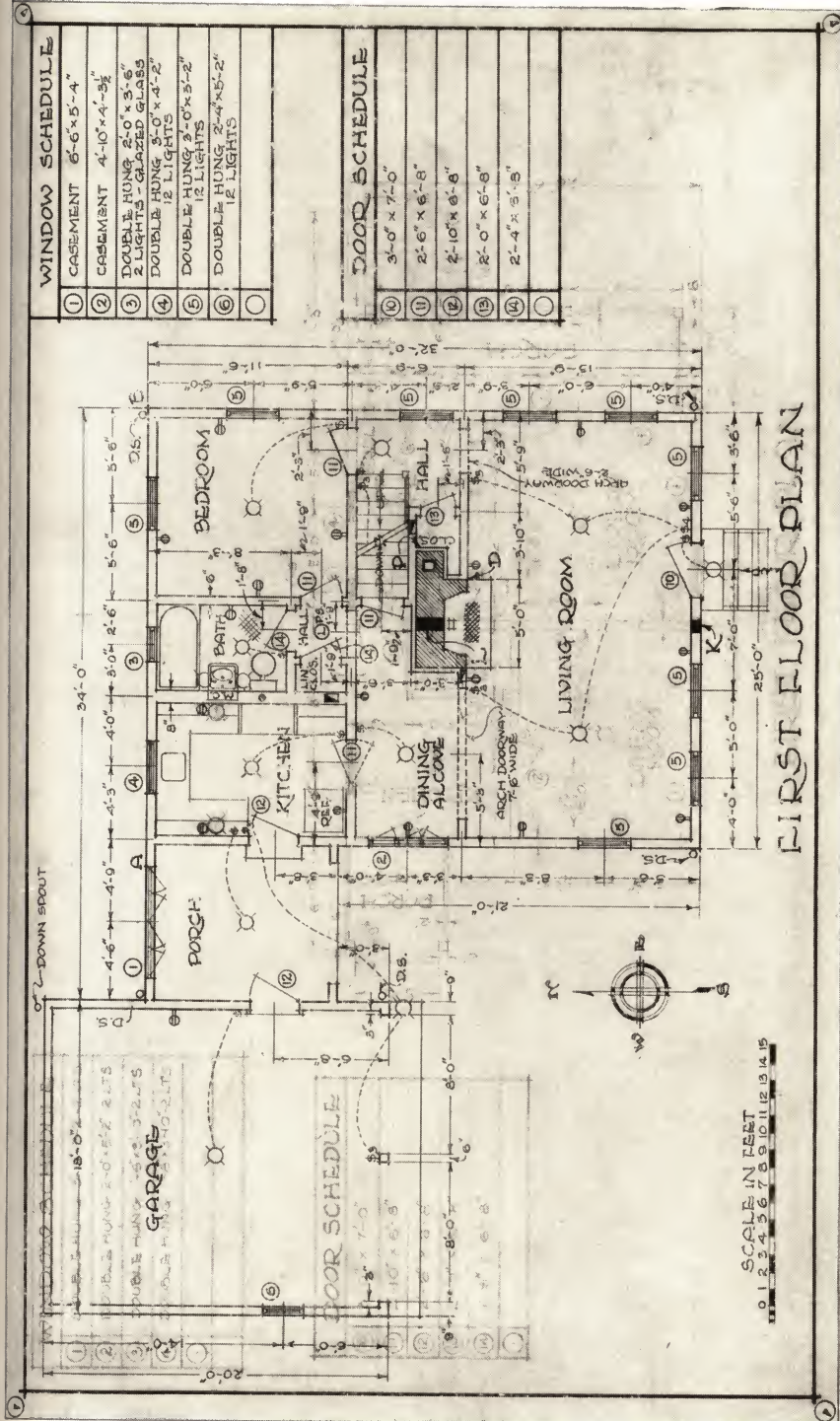


Fig. 295. Step 5 In Drawing Remodeling Plans for First Floor

New Rooms. In Chapter XV we decided that the new kitchen should be about 8'0" wide, that the new bath should be about 5'0" wide, and that the new bedroom should be about 12'0" wide. The kitchen must be in the northwest corner and the new bedroom, which should have windows on two sides, will therefore have to be in the northeast corner. Thus the bathroom must be between these two rooms, where as a matter of fact it is most convenient.

After some trials and thought the dimensions shown on Fig. 293 can tentatively be decided upon. The wall between the bathroom and bedroom cannot be completed because some arrangement for a hall must be made. The wall between the kitchen and the bathroom must be 8" wide, to accommodate a soil stack.

New Window. A new window can be drawn in place of the old front entrance. This will be acceptable from the exterior too, since it will balance the two in the east wall of the living room.

New Doors. A door from the bedroom to the hall near the foot of the stairs will be convenient. The interior kitchen door, in order to keep the kitchen U-shaped, is drawn at the middle of the south wall of that room.

FOURTH STEP. See Fig. 294. At this stage of the plan the fireplace should be drawn. The center of the north wall of the living room wall is selected for the location because the old window locations are not to be changed and in the only other available space, the west wall, the fireplace would jut out beyond the entrance to the dining alcove. It is doubtful if the chimney would look well from the exterior anyway, so the choice seems satisfactory. Also the chimney structure must be used to support one end of the beam which is required in place of the old partition removed in enlarging the living room.

The average fireplace is of the size shown.

Next the closet near the hall at the foot of the stairs can be completed. This will serve as a coat closet for the living room.

Dining Alcove. The space left between the living room and the kitchen can be used for the dining alcove. It comes very near to the dimensions selected in Chapter XV.

Three new windows are planned for the dining alcove, to make it bright and cheery. These windows are close to the proposed new porch, so they will not destroy the balance of the west elevation.

Hall and Closet Near Bathroom. By careful planning of the space at the south end of the bathroom, a small linen closet and a hall can be fitted in nicely. The hall is not large but is ample and even the close grouping of doors is not objectionable.

Arches. Between the living room and the dining alcove a wide plastered arch can be planned. In the event of a large dinner party this will allow overflow of table or tables from the alcove into the living room.

Between the living room and the stair hall a plastered arch can be planned; another arch can be used between the dining alcove and the hall near the bathroom.

The use of arches in this plan, will give an enlarged effect to the rooms and will add charm.

FIFTH STEP. See Fig. 295. At this stage of the remodeling planning, the kitchen cabinets and fixtures and the bathroom fixtures can be drawn in and checked as explained in previous chapters. For example, by making the interior width of the bathroom 5'0" a regulation five-foot tub can be used.

Windows. The windows in the bedroom provide cross ventilation. The east

window balances with other east wall windows. The windows in the bath and kitchen are located for convenience, because balance is not important on rear elevations.

Porch. The new porch is drawn in the location originally planned for it, using about the dimensions selected in Chapter XV. The casement windows on the porch add a pleasing touch to the design and need not be balanced with other windows on rear elevations.

Garage. The dimensions of the garage were selected in Chapter XV. It is located so as not to cut off western light in the dining alcove.

Kitchen Door. The outer kitchen door is located on the west wall near the south end of the room, so as to provide better wall space for cabinets. This will bring it near the dining alcove door, facilitating traffic to and from the garage.

Front Entrance. At the front entrance a small area is drawn to represent a concrete porch, because a standard door of Colonial type can best be used.

By carefully studying these various steps you may learn a great deal about floor plan remodeling.

SECOND-FLOOR REMODELING

The remodeling drawing for the second-floor plan is made much as explained for the first floor.

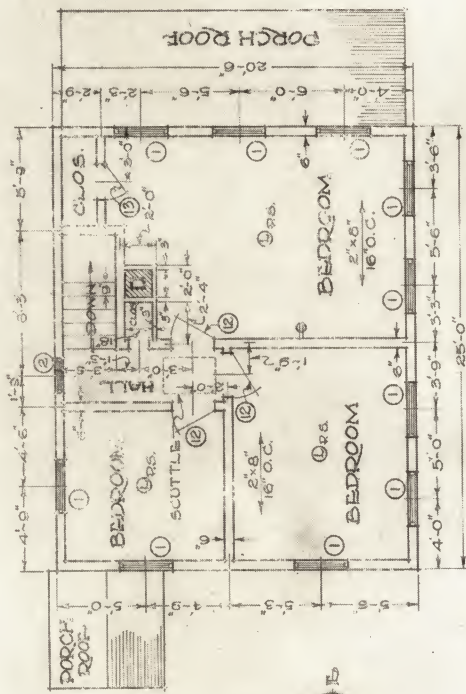
FIRST STEP. See Fig. 296. Here is the second-floor plan of the original house. This drawing was made as explained for the first step of the first-floor plans. Notice that the plan affords only one small closet in the hall and one in the east bedroom and that there is no bathroom. The benefits of remodeling can be shown to excellent advantage using this old plan as a base.

SECOND STEP. See Fig. 297. The old window locations on the west and south sides of the house are not being changed since they balance well with the first-floor windows. On the east side, however, the window farthest north is being moved a little to the north; thus balancing it with the window to be moved into the old door location, below.

In Chapter XV it was decided that the two second-floor bedrooms would remain on the south side and that they should be about 11'6" by 16'0" and 10'0" by 12'0" in size. In this step the south wall and parts of the east and west walls, together with the windows in these walls can be drawn. Keeping the partition between these rooms directly over the line of the beam used in place of the old first-floor partition, makes the width dimensions as shown. These dimensions do not differ greatly from those which we planned in Chapter XV, and they have the added advantage of balancing the windows along the south wall, from inside the rooms. To move the dividing partition either east or west of its present location would ruin the interior impression of symmetrical window locations.

No consideration need be given the exterior because no outside structural changes are being made.

THIRD STEP. See Fig. 298. The addition to the north side of the house can now be drawn in as shown. Note the short line marked with an X. This, as the 11'6" dimension further indicates, represents the outside edge of the new north wall. This wall, however, stops at the second-floor level. Refer back to Fig. 286. Note wall *EG*. This wall corresponds to the new north wall on the first-floor plan. Therefore, the roof is to continue down to cover the addition. In Fig. 298 it is



SCALE IN FEET
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

SECOND FLOOR PLAN

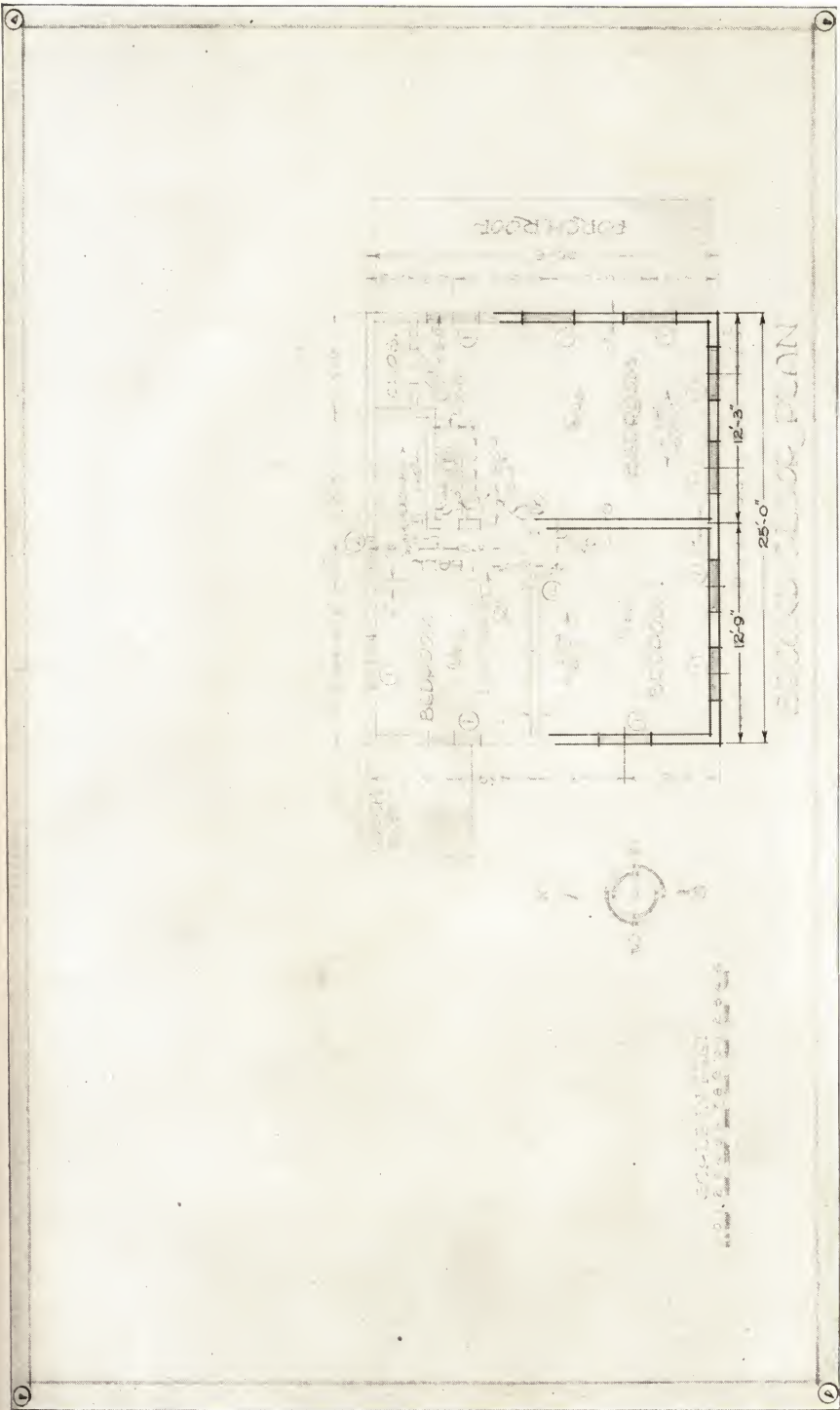
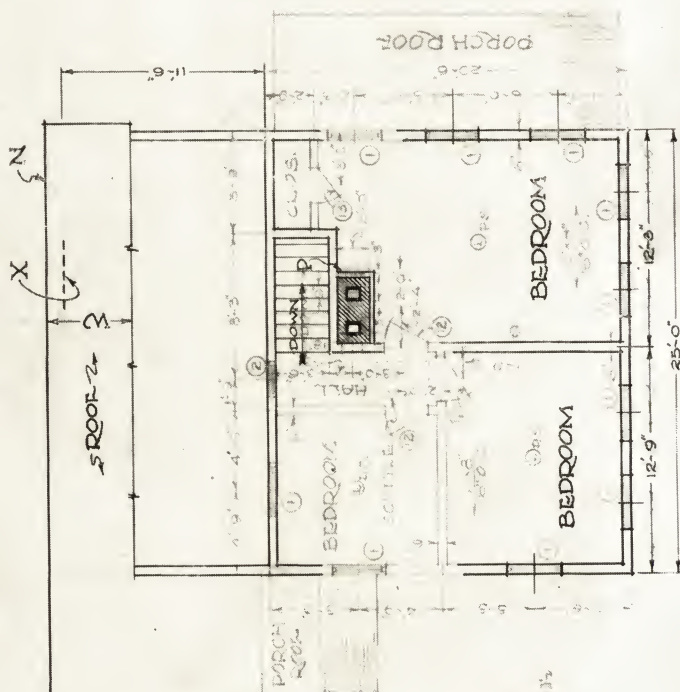


Fig. 297. Step 2 in Drawing Remodeling Plans for Second Floor



SECOND FLOOR PLAN

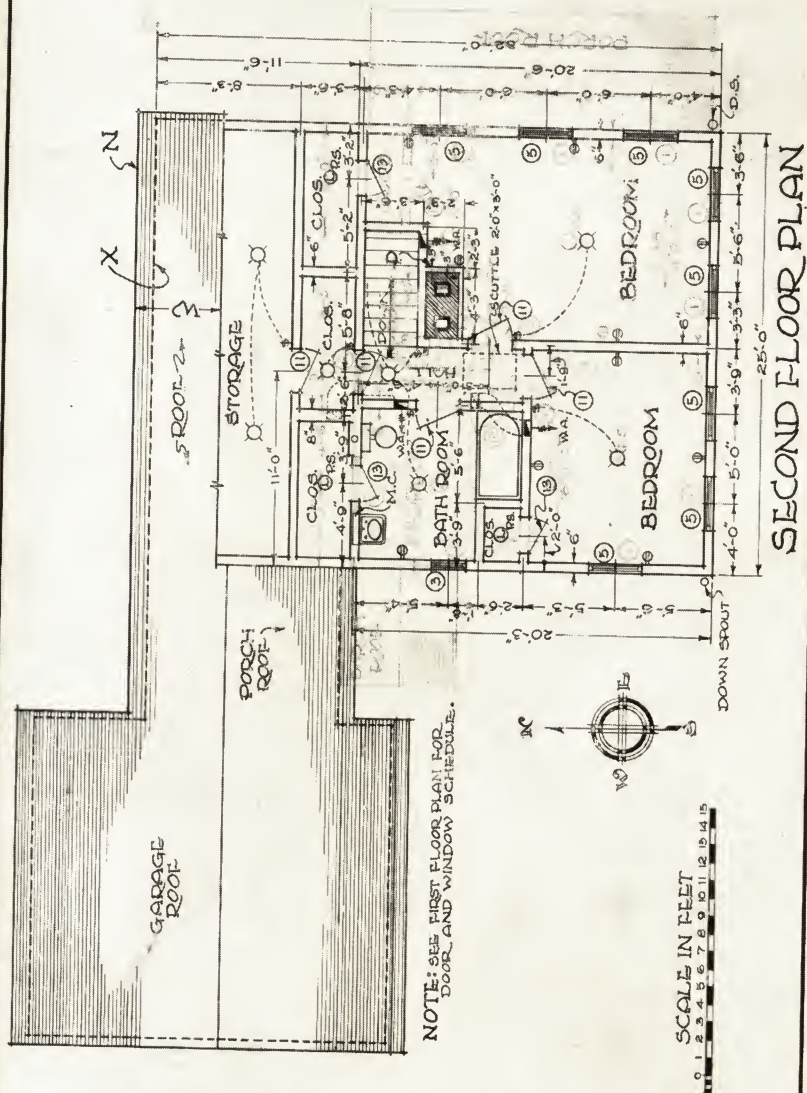


Fig. 299. Step 4 in Drawing Remodeling Plans for Second Floor

shown just beyond *X* at *N*. The distance between *X* and *N* is the overhang of the eave.

Now refer to Fig. 286 again and note the arrow at *Y*. The distance between the point where the arrow intersects the roof and point *E* is similar to the distance marked *W* in Fig. 298. The roof is not shown south of the distance marked *W* because the space between this point and the old north wall can be used for closet space, for which regular symbols must be shown on the remodeling drawing.

In this step the old north wall can be drawn in and partly erased later when the closet doors are located.

The chimney and stairs can also be drawn at this stage, to facilitate the planning of the required hall. The chimney size is average for two flues. Notice that edge *P* of the chimney is the same distance from the east wall as edge *P* in Fig. 294. Above the first-floor ceilings, fireplace chimneys narrow to the size shown.

More information about the chimney is given in succeeding pages.

FOURTH STEP. See Fig. 299. In Chapter XV dimensions of about 6x8 or 6x9 were planned for the new second-floor bathroom. Now, from the remodeling plans, it appears that the old partition between the two west bedrooms, see Fig. 296, can form the north wall of the new west bedroom and provide space for a closet and a recessed bathtub. Thus the old partition is drawn, together with a closet formed by a new short wall about 2'6" to the north. By limiting the width of the new closet, space is allowed for a 5-foot standard recessed tub.

The east wall of the original northwest bedroom can also remain in place and form one wall of the new bathroom and of the hall. The hall will then be at the head of the stairs, and the doors for the bathroom and the two bedrooms will open from it.

The new bathroom is now slightly larger than originally planned. However, this compromise is made in the interest of a minimum of structural change, and the resulting size is not so large as to be objectionable. A new, glazed window will be installed, and it will be away from the tub, which is a desirable feature.

The space above the first-floor addition can now be divided into closets and a storage area. We can make these 3' deep, excluding walls, without the roof slant making their north walls too low. Three closets can be planned as shown; these will be ample for the average house. Doors are provided for each, and a door leads into the storage area from the middle closet. The storage area has a low, slanting ceiling, but if sheathed inside with sheet insulation, it will make a clean and excellent space for storage of things that are not often used.

The larger bedroom has an irregular north wall, but there is ample space south of the chimney for the specified bedroom furniture. The other bedroom is smaller than originally intended. However, this reduction in size meant structural economy, and the room is still fairly large.

Our remodeled second-floor plan is now wholly desirable from the modern viewpoint and is a very pronounced improvement over the old second-floor plan.

Careful study of these various steps, with the drawings, is urged.

BASEMENT REMODELING

Remodeling drawings for basements are made on exactly the same principles as those explained for the first- and second-floor plans and as illustrated by the blueprints in the back of the book.

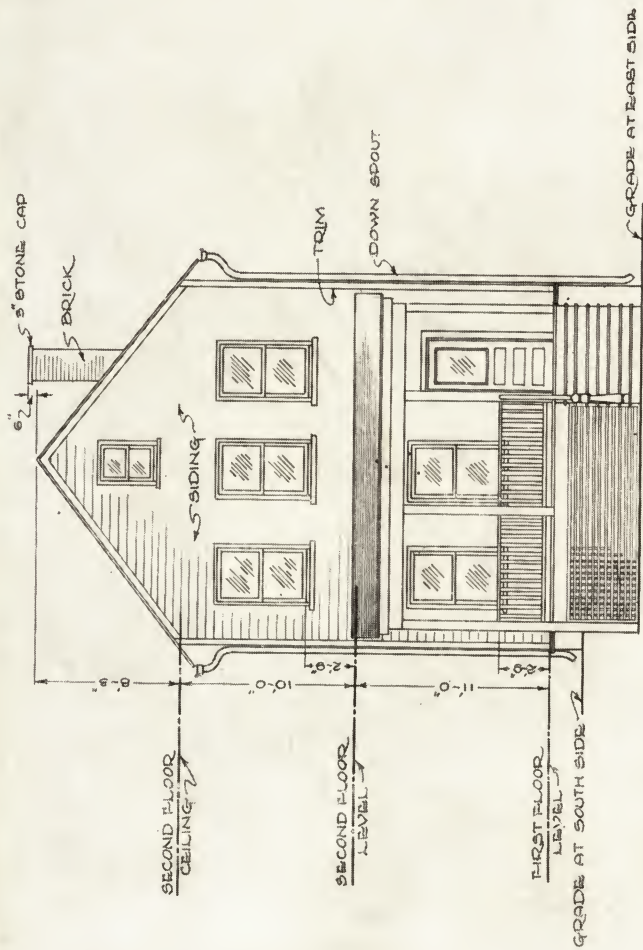
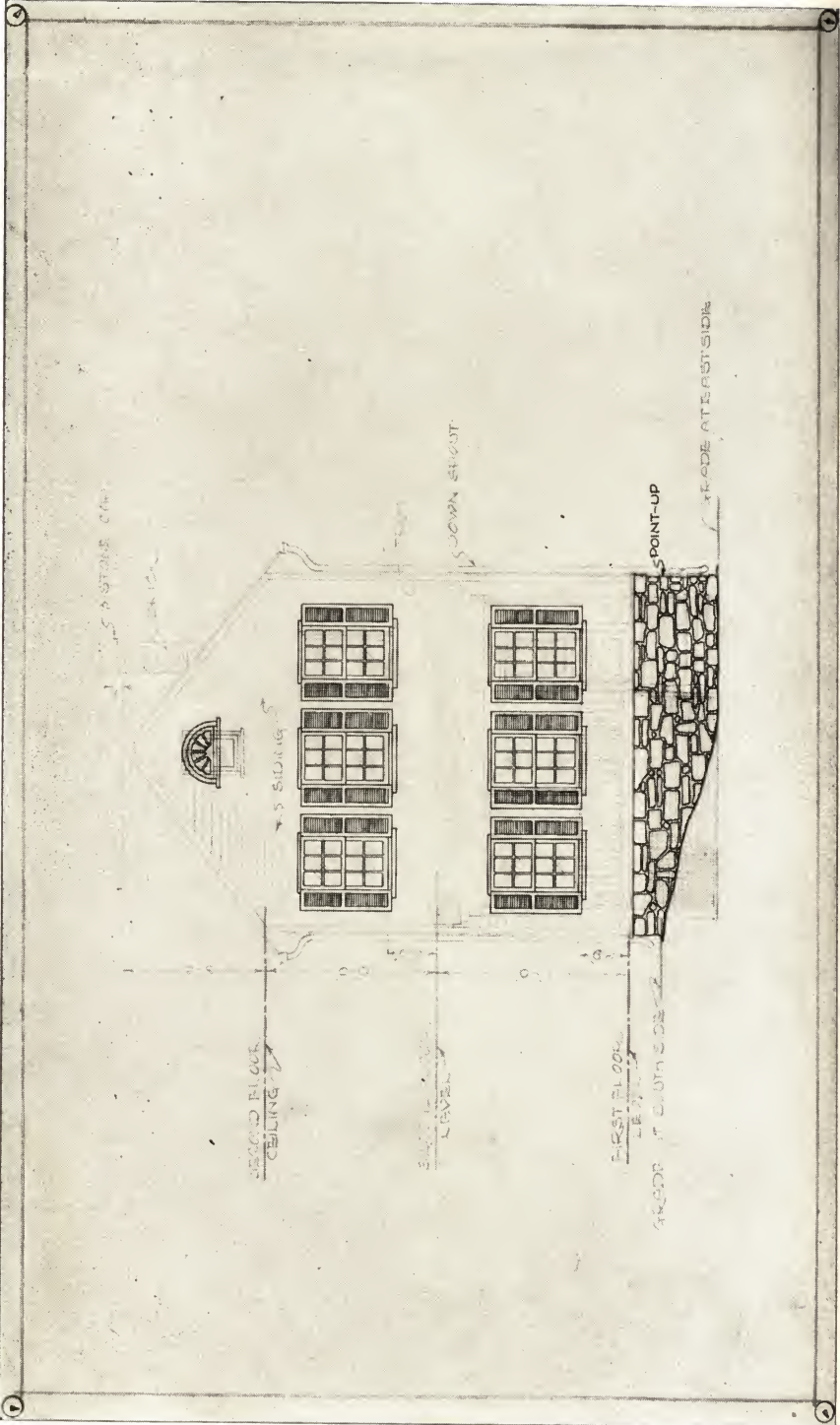


Fig. 300. Step 1. Old Elevation View of East Side of House



ELEVATION REMODELING

Before studying the explanations and illustrations of elevation remodeling, the following facts should be understood:

1. The principles of drawing explained in Chapter VI are followed with but few deviations.
2. The elevation developed is for the house shown in Fig. 281 of Chapter XV, and the floor plans already developed in this chapter.
3. Exteriors were partially planned as the floor plans were developed.
4. The step-by-step procedure employed in developing the floor plans is also used for the development of a typical elevation. The gray and black lines also have the same meanings.

FIRST STEP. See Fig. 300. An elevation view for the east side of the old house is shown here, drawn as explained in Chapter VI. The drawing was made accurately to scale and shows the old porch and steps, the windows, the front entrance door, the old wood siding and trim, the overhanging eaves, the old chimney, and other details.

You will find that this drawing will aid you in developing the remodeling drawings because it shows the window locations (except the north, second-floor window which is to be moved), the front entrance (which is to be replaced by a window), and the wall (on the right) where the addition begins.

SECOND STEP. See Fig. 301. Here again, imagine that a piece of tracing paper has been put over Fig. 300. The thumbtack symbols help to create this impression.

Windows. Assume that a new type of window is required but that most of the locations are to remain the same. The first remodeling drawing shows the new windows plus their shutters. The new windows have divided lights. The old attic window is replaced by a new louvre.

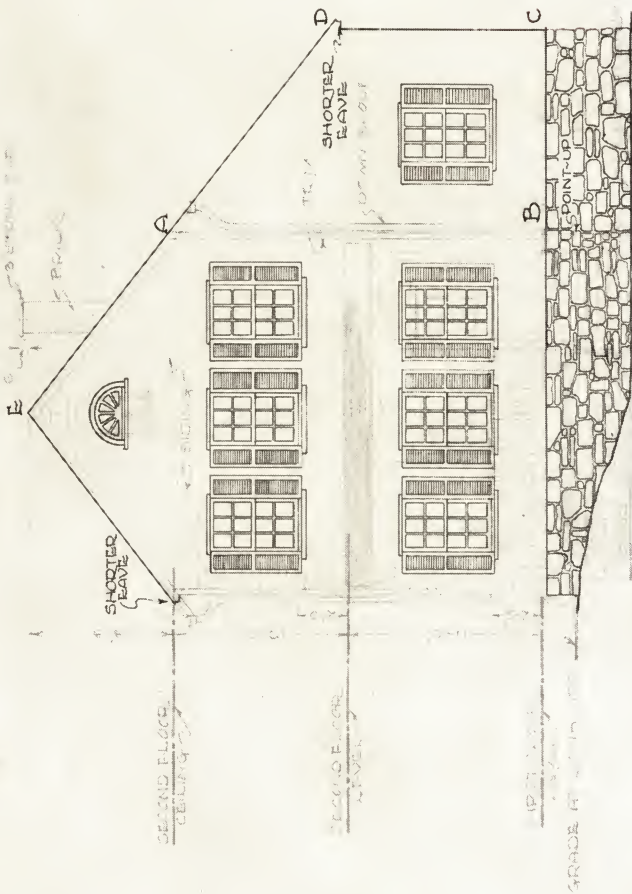
Remove Old Door. Since the entrance door is to be moved to the south elevation, its old location is made over into a window.

Note: Remember that the gray lines indicate the drawing of the old elevation showing through the tracing paper, and that the black lines represent the second step in the making of the remodeling drawing. Neither dimensions locating the windows nor window sizes need be given because with one exception the locations do not change. The new type of windows is explained in the written specifications.

THIRD STEP. See Fig. 302. In this step the addition, $ABCD$, and the necessary foundation, additional window, and shortened eaves are shown.

Addition. The floor plans show that the distance BC in Fig. 302, is 11'6". Line BC is then drawn that length, starting at B . Next the line CD is drawn, allowing the same ceiling height in the addition as was allowed in the old parts of the first floor.

Foundation. Next the new rubble foundation is drawn in, to resemble the old repointed part.



Roof. New roof, AD , is an extension of old roof AE , at the same pitch.

Note: If the addition had been too wide to allow the extension of the old roof at the same pitch, the side CD would have had to be moved closer to the old house, as required. In the event it was moved, the north walls of the remodeled floor plans would have had to be changed also.

Eaves. The eaves have been shortened somewhat, to modernize the appearance of the house.

New Window. The new window in the east wall of the addition is located in accordance with dimensions on the remodeled floor plan, the same size as the other windows.

FOURTH STEP. See Fig. 303. Here the new asphalt shingles are shown. Notice that the old corner trim has been removed. Shrubs shown were planned in order to take away some of the effect of height, and to give the further impression that the first floor is not so far above the ground line.

This view shows the new and higher chimney; a side view of the front entrance steps completes the elevation.

OTHER ELEVATIONS. Remodeling drawings for the other three elevations can be made in much the same manner.

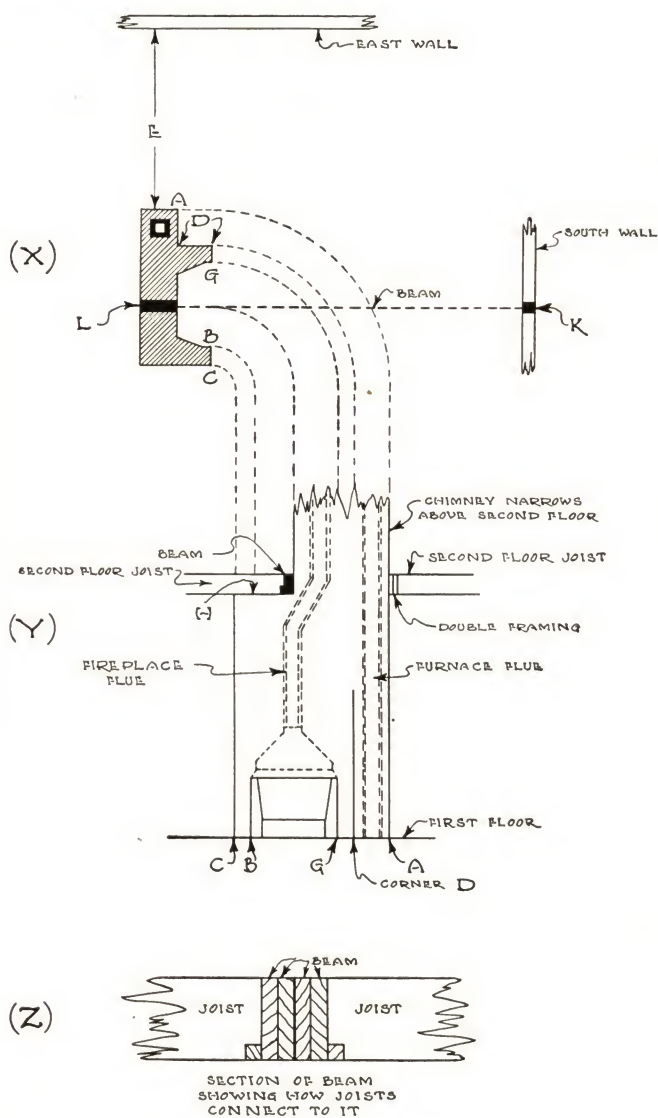
CHECKING REMODELING

When your remodeling drawings are presumably complete, check the important design features to see if all assumptions made during their development will actually work out and if further improvements can be made. The following paragraphs will assist you in checking some of the more important miscellaneous considerations which were discussed at the beginning of this chapter.

LIVING ROOM BEAM. When the partition between the old living and dining rooms was taken out in planning the new living room, it was assumed that a beam could be substituted in its place, in the second-floor framing, to support the second-floor joists and the second-floor bearing partition, and that one end of this beam could be supported by the new chimney structure.

The beam has to extend from the south exterior wall to the fireplace chimney structure and must be of the same vertical dimension (or height) as the second-floor joists which it supports. Refer back to Fig. 295 and note the symbol at K on the south wall. At this point a Lally column or built-up wood column can be put into the wall. Either of these could be supported by the foundation, and would in turn support one end of the new beam.

The other end of the beam can be supported by the chimney structure, whether the beam be of steel, or wood and steel (see Chapter VII).



In order to visualize this beam and its position, refer to the illustrations in Fig. 304.

The plan of the chimney, see *X* in Fig. 304, is shown in the same position as in Fig. 295. Portions of the south and east walls are shown

in Fig. 304 in the same relative positions as in Fig. 295. The distance *E* in Fig. 304 represents the distance from *P* to the east wall in Fig. 295. The beam is shown in *X* of Fig. 304 by a dotted line. The supports for the beam in the south wall at *K* and in the chimney at *L* are also shown, and these same positions can be seen in Fig. 295.

Y in Fig. 304 is an elevation view of the chimney as it would be seen from the living room if no lath or plaster intervened. The light dotted lines may help you understand that the drawing at *Y* is another view of the one at *X*. Also by checking the letters *A, B, C, D*, and *G* in both views, you can better understand the relationship between them.

From a study of the view at *Y* you will see that the width of the chimney above the second-floor level narrows considerably, leaving a ledge at *H*. The beam is shown resting on this ledge.

Z in Fig. 304 shows a section view of a built-up wood and steel beam such as described in Chapter VII which can be designed and checked for necessary strength, as also explained in that chapter.

Many rather complicated problems, such as the beam procedure just explained, are encountered in remodeling work where one objective is to enlarge or alter rooms. These problems merit careful attention, from the standpoints both of economy and of safety. Other problems of like nature are illustrated in the blueprints in the back of the book.

DUCTS. Ducts to first-floor registers or grilles are easy to run because they can be placed along the basement ceiling (for mechanical systems) in any desired position. (See Chapter XIII). Above the first-floor rooms, however, as explained previously, partitions must be used to conceal them. Notice, in Fig. 299, the warm-air grilles for the two bedrooms and the bath.

For the large bedroom the duct was concealed in the partition between the stairway and the closet, shown in Fig. 295.

For the bathroom the duct comes through the 8-inch kitchen partition, and must make a short jog under the floor to the east bathroom partition.

For the small bedroom the duct must come up through the short partition on the east side of the dining alcove arch, then jog diagonally southwest, under the bathtub, to the location shown in the north wall of the small bedroom.

PLUMBING PIPES. Both bathrooms and the kitchen require a soil stack, which, by means of careful planning of 8-inch partitions, can be placed so as to serve all of them.

The 8-inch kitchen partition, shown in Fig. 295, allows the installation of a soil pipe to serve both kitchen and first-floor bathroom. The 8-inch closet partition, shown in Fig. 299, is directly above the kitchen partition, but a jog is necessary to place the soil stack so it will serve the second-floor bathroom.

If possible, use one soil stack instead of two, for it is an economy which will help keep down your remodeling costs.

TRAFFIC. In the remodeled floor plans you will find the following advantages and disadvantages, as far as traffic is concerned.

1. The kitchen doors have been planned so that traffic between the dining alcove and the porch will not disrupt kitchen activities.

2. It is possible to go from the second floor to the basement without going through the living room.

3. It is possible to go to the second floor from the kitchen without going through the living room.

4. The basement door is close to the kitchen.

5. The position of the front entrance makes it necessary to cross through the living room in going to the stairs or to the kitchen. This disadvantage could not be overcome. It is somewhat lessened by the fact that access is provided to the second floor, as well as to the rear part of the house, through the kitchen door.

6. Guests are disturbed whenever the front door is opened, and a caller steps into the living room immediately upon entering the door. These are disadvantages which could not be overcome without the sacrifice of more desirable features.

7. The first-floor bathroom is accessible to guests without their going through the kitchen or the bedroom.

8. The second-floor arrangement is very satisfactory, allowing access to all rooms from the hall, and easy access to the bathroom.

CLOSETS. The closet situation has worked out very well, providing a closet for each bathroom, a closet for two of the three bedrooms, and a cloak closet off the living room. The general closet and storage space on the second floor can be entered directly from the hall. There is no closet for the first-floor bedroom, one disadvantage that could not be avoided without incurring worse disadvantages.

LIGHT AND AIR. Fortunately, it was possible to have ample windows in every room. The windows are located so as to allow the most sunshine in the rooms used more often. All bedrooms have cross ventilation, and the beds can be placed where there will be no drafts across them.

STRUCTURAL ECONOMY. Notice that there were very few important structural changes in the old part of the house. Avoiding excessive changing of window locations and the disturbing of roof or walls, constitutes an important feature of structural economy. The joists in the old part of the house were not disturbed, either. The improvement in exterior appearance was brought about, for the most part, by the use of new windows in the old locations, new shingle siding, new roofing and shutters.

CONCLUSION

In Chapter VI the advantages of making actual scaled drawings in planning remodeling were pointed out. It should be clear to you, now, how much actual benefit is derived from the making of such drawings. These drawings are equally important to the owner and to the mechanics who will carry out the work. It is hoped that this chapter, in addition to showing you how remodeling drawings are made, has furnished the final proof that they are absolutely necessary if good results are to be obtained.

Illustrative Example

THIS chapter presents an illustrative example which completely outlines the planning of a typical remodeling job, for the purpose of showing the way in which many of the principles set forth in preceding chapters are applied collectively to a specific case.

There are a few facts, however, which should be understood in this connection before you proceed with the study of this illustrative example:

1. As indicated by the photographs in succeeding pages, the illustrative example consists of an actual house, for which the planning and the remodeling were carried on as outlined here.

2. Not all of the principles set forth in the various chapters of this book were involved in planning the remodeling of this particular house. However, those employed are typical, and will serve to show you, in general, how all principles are applied.

3. The principles are not applied in the same sequence in which they were set forth in the book. When they were explained, as principles, it was necessary to present them in the order in which a knowledge of one could best be used as a basis for understanding another. In this way, it was possible to base the explanation of each new principle on one or more that already had been discussed. When the various principles are used in planning remodeling, however, the sequence depends entirely on the actual conditions encountered.

4. The example is explained and illustrated so that it will serve to clarify the application of these principles, for the benefit of laymen, carpenters and other building trades mechanics, real estate operators and appraisers—in fact, for the benefit of everyone interested in the remodeling of houses.

5. Certain steps in the planning are not



explained in detail because of the fact that previous chapters contain illustrations or explanations relative to the same house, or one so nearly parallel to it that additional explanations are unnecessary.

THE EXAMPLE. In connection with this example, the following facts may be assumed:

1. Mr. John J. Jones, whose family consists of Mrs. Jones and two growing children, owns an old frame house, a picture of which is shown in Fig. 305.



Fig. 305. Jones House Before Remodeling

2. Mrs. Jones employs a maid who lives in the house.
3. The house contains seven rooms, one bathroom, a basement (fully excavated), and a large attic. The house is situated on a narrow lot.
4. Because the house is old fashioned and poorly suited to modern living, Mr. Jones decides either to build a new house or rather extensively remodel the old one. He finds that he can remodel for much less than the cost of building a new house. This, together with other factors, leads him to decide that he will remodel if further investigation proves that remodeling will be worth while.

HOW THE EXAMPLE IS PRESENTED. The various steps in presentation of the example are outlined briefly in the following paragraphs:

1. Study of the old house from the structural viewpoint, to determine how much of the existing structural work, such as joists, floors, and framing, is in good condition. The results of this study are employed in judging whether or not remodeling is worth while. This study also has a second purpose—the consideration of joist directions, bearing partitions, and like structural details. This information is used in planning remodeling of rooms, as explained in preceding chapters.

2. Study of the old house in relation to such factors as room sizes and shapes, closet space, convenience and efficiency, heating, electrical work, plumbing, and mechanical fixtures. The purpose of this study is to determine approximately what must be done to make the house fit modern requirements. In addition, this study is used as a means of determining whether remodeling will be worth while and also as a basis for remodeling planning.

3. Is Remodeling Worth While? This is answered by using the data gathered in the study, outlined as steps 1 and 2, and by considering other items, as explained in Chapter IV.

4. Determining the remodeling requirements. This preliminary thinking is also explained in Chapter IV.

5. Determining type of remodeling. This study is based on results of the four previous studies, especially step 4. It also includes the application of principles such as those explained in Chapter V.

6. Remodeling rooms, floor plans, and elevations. This part of the work is based on an understanding of the principles explained in Chapters VI, XI, XII, XV and XVI. The items constituting the remodeling are given in outline form with brief explanations. By studying these, and by comparing the remodeled blueprints, shown in Plates 1A through 8A, with the original blueprints, shown in Plates 1 through 8, it is possible to trace the whole remodeling procedure from start to finish.

7. Insulation. This study is based on the principles explained in Chapter IX.

8. Structural Details. This study is based on principles set forth in Chapter VII.

9. Electrical Work. See Chapter XIV for the application of the principles of electrical work to this illustrative example.

10. Heating and Air Conditioning. See Chapter XIII.

11. Decorating. This subject is somewhat outside the scope of this book, except as it can be studied from the specifications in Chapter III.

12. Miscellaneous Items. This includes items which, though important, do not come under any of the steps previously mentioned, such as hardware or millwork or linoleum.

13. Specifications.

Plans. The blueprints (mentioned previously) showing the house as it was before remodeling and also showing the remodeling plans, are in an envelope attached to the back cover of the book. The plans for the original house are shown in Plates 1 through 8, and the remodeling plans in Plates 1A through 8A. These plans, as indicated, were drawn to the $\frac{1}{4}'' = 1'0''$ scale and are so presented that they can be scaled.

The plans for the old house may be assumed to have been made as explained and illustrated in Chapter VI.

The remodeling plans can be assumed as having been made as explained and illustrated in Chapters VI and XVI.

Step 1. Study of Old House from Structural Standpoint. The following data are set forth as they would accumulate during an actual inspection of the house. The items given are those which should be examined in any old house before deciding whether or not remodeling is worth while.

Foundations. As indicated in Plate 1, the old foundations are of masonry construction and of great thickness. The mortar joints are good but need repointing both inside and out. There is no doubt but what this foundation is in excellent condition and that it could safely support many times the required load. See Fig. 306.

Footings. The footings consist of large slabs of stone which are still intact and in good condition. The ground is dry and there is no reason to fear any settlement.

Basement Floor. Only the northern half of the basement floor is concreted, and this must be removed because it is badly cracked, uneven, and not sloped as required for laundry floor drains. See Fig. 306. There is evidence that the concrete was not properly mixed when it was originally poured. The earth is perfectly dry, so no drain tile will be required before a new floor is poured.

Joists. First Floor. The joists supporting the first floor are 2x10's, spaced 12 inches center to center, and have bridging even on short spans. The wood is in good condition and without doubt has ample strength. The joists run east and

west and are supported by a wooden girder running north and south the full length of the house. See Plate 1.

Second Floor. The joists supporting the second floor are also 2x10's but their spacing is 16 inches center to center. They run east and west and are supported by a bearing partition which runs north and south the full length of the house. See Plate 2.

Note. Hidden joists, as in second floors, can be studied by means of the lath marks showing through the plaster, from old plans, and by judging the total floor framing thickness at stair wells and deducting floor and plaster thicknesses.

Attic Joists. The joists supporting the attic floor are 2x8's and their spacing is 16 inches center to center. See Plate 3. Attic-floor joists usually can be examined by removing a board in the floor.



Fig. 306. View in Basement of Old House Showing Masonry Walls and Cracked Concrete Floor

Rafters. The rafters are 2x6's spaced 16 inches center to center. See Plate 3.

Bearing Partitions. The bearing partitions in the first and second floors run north and south through the center of the house and are composed of 2x4's, spaced 16 inches center to center. See Plates 2 and 3.

Framing. The joists under all nonbearing partitions are doubled. All joists around openings are doubled.

Girders. The first-floor bearing partition and the inner ends of first-floor joists are supported by 6x8-inch solid wood girders. The inner ends of the girders are supported by the old chimney structure, and at their midpoints by wood posts on stone footings.

See Plate 1. The girder running from the south foundation wall to the chimney is cracked, has the appearance of being a poor timber, and should not be

trusted. Evidently the second of the two wood posts near its midpoint was added to strengthen it at a previous time.

The wood supporting posts have apparently dry rotted and should not be trusted.

A new girder and post are needed, if the house is to be remodeled. A steel beam, not requiring a support at the center, could be used. The steel beam could also be flush with the bottoms and tops of the joists to save head room, if the south end of the basement is planned as a playroom.

The girder running from the chimney to the north wall is in good condition. However, the wood post is partly rotted and should be replaced with a steel lally column.



Fig. 307. Main Stairway in Old House

Wall Framing. The studs in the outside walls are 2x4's, spaced 16 inches center to center. The Western-type framing was used.

Chimneys. There is a chimney running from the kitchen up through the second floor and out through the roof. This was evidently used for an old cook stove. This chimney should be removed, as it would serve no purpose in a modern kitchen.

The main chimney was originally built to serve a fireplace and the furnace and thus has two flues. There is no flue lining and the mortar joints are not in good condition. It is advisable to rebuild this chimney entirely, as in its present condition it is a fire hazard.

Fireplace. See Plate 2. The fireplace is badly burned and in poor condition. Its design, throat, and other parts are old and in poor working order. Modern

firebrick were not available when it was built; it now constitutes a fire hazard, and detracts from the appearance of the room.

Front Porch. The woodwork of the front porch is in good condition but the design is poor and the concrete steps are worn and settled on one side. The porch should be redesigned and new steps provided. See Fig. 305 and Plate 5.

Back Porch. Evidently the woodwork of the back porch was not painted enough, because it is badly rotted near the ground and must be replaced. The upper part of the porch, while not rotted, is of poor design and is an eyesore. It should all be removed and a much smaller porch substituted. See Plate 6.

Siding and Trim. All siding and trim is in good condition except that re-nailing is needed in places and repainting required.



Fig. 308. Basement Stairway in Old House

Roof. The main roof is in good condition and requires but little repair work.

Basement Shelves. See Plate 1. These shelves are badly broken and serve little good. They should be removed.

Windows. See Plates 5, 6, 7, and 8. All windows, window frames, and sash are in good condition. Some of the first- and second-floor windows are not well located (northeast corner of second floor, for example) but are in good working order. The frames and sash need repainting, and weather stripping should be applied. The basement windows, see Fig. 306, are small but good.

Stairs. Main. The main stairs take up a great deal of room. See Plate 2 and Fig. 307. They are badly worn and not well finished. They were designed during an era when a great deal of "gingerbread" woodwork, seats, and other adornments were popular. It would be impossible to improve their appearance,

so they should be removed in part and replaced by a modern stairway, as shown in Chapter VIII.

Basement. See Fig. 308. These stairs are in very poor condition and are a hazard because of the open risers. The framing around them is unsightly and not well constructed. Stairs and framing should be redesigned and rebuilt.

Attic. The attic stairs are in good condition and would require only refinishing to make them acceptable, even if the third floor were remodeled so as to contain a bedroom or two.

Flooring. *First Floor.* The finish flooring has been badly darkened by varnishing frequently, without proper preparation each time. Some of the boards are irregular, there are rather large joints in places, and it is doubtful if even sanding would make any decided improvement in the appearance of the floors as a whole. Apparently the flooring was put down improperly in the original construction. If, in remodeling, it were decided to use all-over carpets or linoleum, the floors could be repaired and sanded to form a satisfactory base.

Second Floor. The same floor condition exists as reported for the first floor. Linoleum or carpeting would be about the only satisfactory solution unless entirely new flooring were applied as explained in Chapter X.

Attic Floor. This floor consists only of rough flooring which is sound and in good condition.

Plaster. There is evidence that the plaster, at the time the house was built, must have frozen before it dried. All of the walls and some of the ceilings in the first and second floors are badly cracked, and in some places there is no plaster at all. It is reasonable to assume that most of the plaster can be repaired without having to tear it out entirely and replace. However, such repairing would not look well unless the walls, especially, were covered with paper, canvas, or linoleum.

Kitchen Wainscot. This material extends 3'1" up from the floor and is old-fashioned, dirty, and in bad repair. In the event of remodeling it should be torn out entirely and the walls covered with some prepared surfacing.

Dining Room Bay Windows. These windows are a relic of old-fashioned house planning and would not fit in with modern dining room treatments. They can be removed with but little cost and their removal would be a real improvement.

Insulation. There is no insulation of any kind. This is an important item because in old houses the walls are not so tight as in new houses, thus allowing a much greater heat loss in winter. The framing of the house is such that it easily could be insulated, and this would be required for a modern heating and air-conditioning system.

Bathroom Floor. This floor, probably due to dampness, is badly rotted, dangerous, and unsightly. The joists under it, however, are in good condition. A new tile floor would be advisable.

Interior Woodwork. As is often the case in old houses, the woodwork, such as bases, and door and window frames, has warped somewhat and therefore requires renailing and lining up. Refinishing is also necessary.

Hardware. In many cases items of hardware, such as door sets and butts, need replacing or repairing.

Fresh-Air Vent. The fresh-air vent in the basement, *F.A. Inlet* on Plate 1, is out of date and should be replaced by a regular window.

Driveway. The driveway needs repairing in spots. This can be done easily by replacing a few squares.

Electric Meter. The electric meter should not be in the kitchen. Most modern houses make provision for it on an outside wall, where it is out of the way and can be read without trouble to the occupants of the house.

Step 2. Study of Old House from Point of View of Rooms, Arrangements, Fixtures, and Appearance. Once the all-important structural items have been checked, the rooms, arrangement of rooms, fixtures, appliances, appearance, and other supplementary details, should be studied with a view to determining present conditions; as a



Fig. 309. Old Furnace in the House Before Remodeling

basis for deciding whether remodeling is worth while; and as a means of planning the remodeling requirements. The items noted can be written down in the following manner for ready reference. This is somewhat different from Step 1, where a more detailed investigation had to be made.

Basement. See Plate 1.

1. The old furnace is worn out and a far cry from modern equipment. The pipes are bent, sagging, and coming apart; also they take up a great deal of room in the basement. See Fig. 309. The wall stacks have fallen apart in places, the boots are in bad shape, and the old-style floor registers are unsanitary, inefficient,

and unsightly. In the event of remodeling, a new modern furnace with automatic controls and at least winter air-conditioning features must be included.

2. The hot-water tank and heater, Fig. 308, are relics of the days when to take a bath during the summer meant running down to the basement to light the gas burner, and then waiting an hour or more for the water to heat. The tank is badly rusted and leaks. The heater is rusted and inefficient. Both should be replaced by modern equipment.

3. The laundry trays are old fashioned and in bad shape. No hot-water pipe is attached to them, and there is no drain near by in the floor. The trays are corroded, dirty, and unsanitary.

4. The entire basement is unfinished and barren. There is no clean area for laundry work, and no means of drying clothes during rainy or cold weather. The whole area is dirty, and needs sheathing and complete remodeling to conform to modern standards (see Figs. 306, 308, and 309). All this could be done easily and economically.

5. The basement is large, constituting an enormous amount of wasted space. A playroom plus laundry and furnace room could be built and would add to the desirability of the house.

6. A good feature of the original basement is that it is always dry. This means that a recreation room could be constructed without the expense of drain tiles or waterproofing.

7. The electric wiring looks more like an old spider web than like safe, modern electric service. The wires are exposed and held in place with bare nails. There are only two lights. Complete new wiring is needed.

8. The plumbing pipes are cracked, see Fig. 308, and were not installed in accordance with present-day codes. In the event of remodeling, it is likely that all new plumbing would be required, depending on a careful examination of the vent, wastes, and drains.

First Floor. *Living Room.* See Plate 2.

1. The old vestibule takes up valuable space and is not a necessary feature. From a casual observation, it is obvious that its removal would add desirable area to the living room and make it possible to include in the living room the small room at the foot of the stairs.

2. The small room near the stairs is useless by itself; it would not lend itself to any modern floor plan, unless remodeled into a study or small library. Adding it to the living room would be more desirable.

3. The present living room is too small, and is badly shaped for the arrangement of modern furniture—inadequate for the constant use imposed by modern living.

4. The old stairs, Fig. 307, are out of date and take up too much room. The seat is a relic of notions popular some years ago. A new stair, at least to the landing, could be placed next to the outside wall. This stair would be modern and attractive, and it would require much less room.

5. The sliding door between the living room and the dining room is a device long out of date. This one will not work, due to settlement which probably occurred years ago. In remodeling, this door would be one of the first items eliminated.

6. The light fixtures were designed at the time when combination gas and electric light fixtures were common, in order to make sure of some kind of light.

The wiring is dangerous and there are few outlets. Complete new wiring should be a part of any remodeling.

Dining Room. See Plate 2.

1. The pantry, serving room, and love seat corner room at the north end of the dining room (see Fig. 310) also are relics of long ago. The pantry and serving room combination, according to our modern notions, is highly inefficient, constituting nothing more than unsightly doors and small spaces which are hard to keep clean. In a modern house these three rooms would serve no purpose, and should be removed in remodeling.

2. The fireplace, as discovered in Step 1, is worn out, dangerous, and un-



Fig. 310. North End of Dining Room Before Remodeling

sightly. It takes up space which, in a dining room, would be better used for a china closet.

3. If the old bay windows were removed and the wall straightened, the dining area easily could be remodeled into a modern room, with ample wall space for dining room furniture.

Kitchen. See Plate 2.

1. The old sink shown in Fig. 311, the gas stove, and other fixtures are unsightly, unsanitary, and inefficient. All of them should be removed, along with the chimney, in the event of remodeling.

2. The kitchen is about the size required and could easily be modernized into an efficient and desirable room.

3. The light fixtures, Fig. 311, should be replaced with modern fixtures and new wiring.



Fig. 311. Kitchen Sink Before the Kitchen Was Remodeled

Hall. The hall is well located, and will serve its purpose almost any way the rooms are remodeled.

Closet. There is only one small closet, which would hardly serve as a coat closet, not to mention storage space for card tables, folding chairs, and other items in common use in modern living rooms. In the event of remodeling, additional closet area must be planned.

Second Floor. Bathroom. See Plate 3.

1. The fixtures are hard to keep clean and to clean under and around; they are old fashioned, noisy, badly worn, and most unsightly. See Fig. 312. They should all be removed and replaced by modern fixtures.

2. There is no towel closet or other provision in the bathroom for storage of such necessities.

3. There is no medicine cabinet, and the mirror is too small and in an unhandy location.



Fig. 312. Bathroom Fixtures Used in the House Before Remodeling

4. The bathroom is too small to accommodate modern fixtures and still allow ample room between them. In the event of remodeling a two or three-foot addition would be necessary.

5. For a house of this size one bathroom is not enough.

6. The old window location and size is all right.

7. There is a ceiling light only; no convenience outlets.

Bedroom 1. See Plate 3.

1. This room is somewhat too large and of poor shape to suit the needs of a modern bedroom. It could be cut down in size a few feet, if necessary, to provide space for a second bathroom.

2. The closet is much larger than necessary. Part of this closet space could also be used for a second bathroom.

3. There is one small ceiling light.

Bedroom 2. See Plate 3.

1. The size and shape of this room would not need to be changed.

2. There is no closet and in the event of remodeling a new closet must be provided.

3. The window sizes and locations are all right.

Bedroom 3. See Plate 3.

1. This room is the least desirable as a bedroom because of its exposure; it could only be used as a spare bedroom for the overnight guest. Its size could be reduced by two feet, to make the old bathroom larger.

2. The old closet can be removed and a new one planned in connection with the bathroom and the required towel closet.

3. The window position is all right as it is.

Bedroom 4. See Plate 3.

1. The old closet is larger than necessary. Part of it can be used to make space for a second bathroom.

2. The room is of good size and shape for a master bedroom.

3. The windows are ample in number and fairly well located.

4. There is only one small ceiling light.

5. In the event of remodeling, two or more convenience outlets should be added.

Third Floor. See Plate 4.

1. The attic space is unfinished except for rough flooring.

2. There are ample dormer windows so that one or two good sized bedrooms could be built, together with a bathroom.

3. The old back chimney can be removed.

4. The stairs are in good condition and require only refinishing.

5. There is only one light in the entire space.

6. The roof is high enough so that any room or rooms made would have good ceiling heights over most of their area.

7. Lathing and plaster could easily be applied to existing framing, and new partitions could be added as required.

Elevations. See Plates 5, 6, 7, and 8. From the standpoint of appearance, the exterior of the house is old-fashioned, and, compared with a modern Colonial house, for example, uninteresting and not very desirable. Yet there is a certain sense of proportion about it which seems to catch the eye and hint at the fact that a few simple changes might produce a more modern effect, without causing

too much difference between it and the other old houses in the neighborhood.

The addition of a wing on either side is impossible because, as shown by Fig. 305, the lot is too narrow. Adding to the rear would not be feasible because the roof would then have to be rebuilt entirely in order to be in good proportion with the enlarged house. Therefore, it seems advisable to confine the exterior changes to improvements in the design of porches, a better window balance, and modern decorating.

The two porches detract from the appearance of the house because neither of them is very closely related to the design of the main part of the house. For example, note the difference in pitch of the front porch as compared to that of the main roof, Fig. 305. This difference tends to garble the design, so to speak, and the confusion detracts from the appearance of the house. The same thing is true of the back porch, though to a lesser degree.

Pitch corrections to the front porch could not be made, first because the roof would then interfere with the second-floor windows, and second, because the porch would look top-heavy. Therefore about the only solution would be to make the roof flat, enclosing it with a simple wood railing. If Fig. 305 is visualized with this change in mind, a decided improvement will be seen.

Another objectionable feature of the front porch is the location of the steps and front door. Both are almost centered on the front elevation, which is not good design except where a house is rectangular in shape, with the door centered on the long side, or unless there is no porch at all.

In Fig. 305, having the door and steps so near the center of the house creates an unattractive, stiff, and box-like impression. If the house is imagined with the door nearer to one corner, and the steps at the end of the porch, the benefits of the change will be apparent.

The rear porch looks like an afterthought, tacked onto the house after it was built. The lack of relationship between it and the house makes its appearance objectionable. Since rear porches are no longer considered a necessity, the house would be greatly improved if a small platform were built to replace this porch.

During the remodeling of the interior, it will probably be feasible to relocate a few of the windows. This would make for further improvement to the exterior.

The decorating scheme emphasizes some of the old-fashioned features. This could be overcome by painting the house white, or off-white, with no contrast between trim and main walls.

It is reasonable to assume that such changes as have been contemplated, with repointing of the foundation, roof repair, and other miscellaneous repairs, would make a considerable improvement in the exterior appearance of the whole house.

Step 3. Is Remodeling Worth While? In Chapter IV, the discussion as to whether or not remodeling would be worth while ended in the conclusion that it was. Although this generally is the case, there are still many exceptions to the rule, and it is always a good policy to go through with this preliminary thinking and answer the question before proceeding too far with actual planning.

Obtaining a Loan. Ordinarily owners do not want to pay outright for remodeling, but desire to take advantage of the many possibilities for borrowing the

required money on terms that will allow them to pay it back a little at a time. In this connection, the old house, the approximate cost of remodeling, and qualifications as to location should be considered carefully.

The checklist set forth in Chapter IV under the heading *Is Remodeling Worth While?* should be applied, because the factors itemized there determine to a large extent what the chances of securing a loan will be.

For this house, the following qualifications in reference to location may be assumed:

1. The house is located in an old but well-kept section of the town, where property values are still high because of the following facts:

a) The business area, shops, stores, and theaters are within easy walking distance, yet are not close enough to cause noise, parking troubles, congestions, and like annoyances.

b) Schools and churches are near.

c) Fire and police protection are excellent.

d) The neighbors are good, sound business people who take pride in their homes and see to it that the city maintains streets and utilities.

e) Transportation is good; there is a large park in the district; and the various schools maintain recreation areas for the children.

f) There are no through highways and the surrounding districts are all residential and on the good side of the city.

With such qualifications as to location, there would be little danger of a loan application being denied, provided that other matters of concern, such as good design, conservative planning, and costs were acceptable.

Amount of Remodeling. At this stage in the preliminary thinking the exact remodeling requirements are not known. However, Mrs. Jones undoubtedly has many ideas as to what she would like, in the event remodeling is definitely decided upon. These ideas can be clarified by study of the outlines given under *What Constitutes Remodeling?* in Chapter IV, and checked by the checklist under *Is Remodeling Worth While?* in the same chapter. Here it is assumed that all ideas prove worth while.

(Preliminary ideas relative to remodeling were discussed in the preceding pages under Elevations.)

Structural Qualifications. The study in Step 1 brought out the fact that the main structural parts of the house were in good condition generally. The few items in bad condition were such as could be repaired or replaced with moderate expense and without any major structural changes. This summary, naturally, must be based on the fact that an old house cannot be made as perfect as a new one.

Rooms, Arrangement, Appearance, etc. In the study explained in Step 2, a considerable number of old-fashioned features, poor room shapes, lack of bathroom facilities, worn-out equipment, and like defects were noted. Yet in all cases these objectionable items were such as could be improved considerably without great trouble and expense.

The rooms, their sizes and shapes were not seriously objectionable, and it was decided that remodeling could easily improve them and could make possible all modern conveniences.

Objectionable features, such as poor floors, bad plaster, and woodwork in need of repair, could be overcome, with some compromises being made. For

example, it was previously noted that the old floors could never be improved to the point where they would be usable without some covering such as linoleum or carpeting.

As to worn-out mechanical equipment, its replacement is easily justifiable when it is considered that corresponding equipment would have to be purchased for a new house.

Owner's Viewpoint. It may be assumed that the owner and his family like the neighborhood and location, because of long association, because their friends live there, because it is not too far from Mr. Jones' business, or for other reasons. These considerations, added to the conclusions already reached in the foregoing discussion, are assumed to have convinced Mr. Jones that remodeling would be worth while.

Step 4. Remodeling Requirements. Once the decision to remodel a house has been made, the next logical step is to determine what the remodeling requirements are. It is wise to make a list of the principal items desired. This list can then be used as a basis for remodeling rooms, floor plans, and elevations, as explained in Chapters XI, XII, XV and XVI.

In Chapter IV, under Remodeling Requirements, there are checklists or outlines which should assist Mr. and Mrs. Jones in determining exactly what their remodeling requirements are.

It may be impractical to try to visualize, or to include in a list of remodeling requirements, every individual and minor change or addition. If the important requirements are noted, the lesser items will reveal themselves as the planning of rooms, floor plans, and elevations progresses. For example if a new bathroom is to be added, the resulting changes in the other rooms will be seen as the floor planning proceeds, and the lesser related items then can be considered.

REQUIREMENTS. The following typical list sets forth the principal requirements in the remodeling of the Jones house:

Basement

1. Add large playroom with fireplace, plastered walls and ceilings, and linoleum floor.
2. Rebuild the basement stairs and make them more in keeping with the main stairway.
3. Install combined laundry and furnace room.
4. Put in new laundry trays and a gas burner for boiling clothes.

First Floor

1. Provide a much larger living room—across south end of floor plan.
2. Install living room fireplace.
3. Plan for two new closets near living room.
4. Have front door opening directly into one end of living room.
5. Put in a powder room between living room and dining room.

6. Install a modern kitchen handy to the dining room, central hall, and rear entrance; and add a new and modern rear porch.

7. Plan for a modern dining room with ample wall space, china cabinet, and French doors opening to a flagstone terrace outside.

8. Hall must contain doors to all rooms and closets.

9. Build new stairs up as far as the landing.

10. Have new front door and front door location.

11. Arrange for terrace outside dining room.

12. Redesign the front porch to give it a more modern appearance.

13. Remove bay windows in dining room.

14. Rearrange doors and windows to best suit traffic, light and air, and elevations.

15. Add new casement windows in the kitchen in place of old double-hung windows.

16. Repair floors and plaster.

17. Renail and repaint trim.

Second Floor

1. Redesign and enlarge old bathroom.

2. Add a second bathroom with all new fixtures.

3. Reduce size of large closets.

4. Plan new closet for bedroom where none exists.

5. Provide towel closet for old bathroom.

6. Provide a linen closet in hall.

7. Relocate windows and doors to best suit traffic, privacy, light and air, and elevations.

8. Reduce size of southeast bedroom.

9. Retain four bedrooms. One may be small.

10. Repair floors and plaster.

11. Renail and repaint trim.

Third Floor

1. Add bedroom of good size in south end of attic.

2. Add new bathroom with all modern fixtures.

3. Add new closet.

4. Plan hall at head of stairs so it will have doors to the unfinished section and to the new section.

5. Plaster walls and ceilings. Plan linoleum floor.

Elevations

1. Redesign front porch.

2. Replace rear porch with platform.

3. Point foundation.

4. Repaint.

5. Renail sheathing and shingles.

6. Redesign downspout system.

Miscellaneous

1. Install new gas-fired winter air-conditioning system with all new duct-work and grilles.

2. Install new automatic gas water heater.

3. Wherever new trim is required, use same pattern as old.

4. Install new plumbing as required.

5. Patch driveway.
6. Install new wiring and lights.
7. Insulate for comfort and fuel savings.
8. Build new chimney to accommodate two fireplaces and a furnace flue.

Step 5. Type of Remodeling. From a study of the remodeling requirements, it is clear that partial remodeling (as explained in Chapter IV), is planned. The Jones residence from the standpoint of structural size and shape, and of location, lends itself best to this type of remodeling.

Step 6. Remodeling Rooms, Floor Plans, and Elevations. As explained at the beginning of this chapter, the remodeling for the Jones residence was carried on by using the principles explained in previous chapters. The complete remodeling plans are shown in Plates 1A through 8A.

The following outline gives the details of the remodeling in complete form. These include the remodeling requirements and all the lesser items encountered as the planning was carried on. By careful study of the outline in conjunction with the remodeling plans, you can trace the entire procedure. Or, for practice and experience, you might actually plan each of the rooms and develop the floor plans and elevations on tracing paper after studying this step of the explanations.

Basement Remodeling. See Plate 1A.

1. New concrete floor all over basement.
 - a) Floor drain in laundry area.
 - b) In the playroom area place sleepers in the concrete and 1x4-inch fir flooring over the sleepers. Linoleum over wood floor.
2. Make left side of basement into a large playroom. See Plate 1A.
 - a) Have hall at foot of basement stairs.
 - b) Plaster walls and ceilings.
 - c) Use Rocklath lathing.
 - d) Fur foundation walls.
 - e) Fur down ceiling to hide ducts. (See Chapter XIII.)
 - f) Install fireplace. (See Specifications in Chapter III.)
 - g) Build two areaways for windows using steel as retaining walls. Use steel sash in windows.
 - h) Use regulation trim in playroom and hall.
3. Build new three-flue chimney with rectangular terra cotta flue lining. Use concrete footing under chimney.
4. Install gas-fired winter air conditioning. (See Chapter XIII.)
5. Rebuild basement stairs completely, making them same quality as attic stairs.
6. Install new automatic gas water heater, to be connected to furnace for winter heating of water. Install new water storage tank.

7. Make regular window out of old fresh-air vent.
8. Remove old two-piece wood beam between the two wood posts and install an 8" I beam, one end to be supported by foundation and the other by chimney structure.
9. Replace other wood post with lally column four inches in diameter. Place concrete footing.
10. Install new laundry tray.
11. Brick up window opening at north end of basement.
12. Make north half of basement into a combined laundry and furnace room.

- a) Fur foundations.
- b) Sheath all walls with D. and M.
- c) Use plasterboard on ceilings.
13. Make foundation for new rear entrance out of 8" concrete blocks.
- a) Pour footings of concrete.
- b) Make concrete floor slab and concrete steps.
- c) Construct railing as shown in plans and described in specifications (Chapter III).
14. Make foundation for new terrace of stone.
- a) Fourteen inches thick
- b) Concrete footing
- c) Concrete floor slab over cinder fill. Concrete steps.
- d) Flagstones set in concrete floor. See Plate 2A.
- e) Railing as shown in plans and described in specifications (Chapter III)

First-Floor Remodeling. See Plate 2A.

1. Make new large living room across south end.
- a) Relocate front door.
- b) Build new fireplace. (See Chapter III.)
- c) Build new stairs to first landing. See Chapter III for iron railing.
- d) Patch and sand floor for carpet.
- e) Renail woodwork.
- f) Construct 8-inch partition, as shown in plan, for soil stack.
- g) Make plastered arches to hall and powder room hall.
- h) Remove south window.
- i) Install Flitch girder in place of old partition.
- j) Patch plaster for papering.
- k) Use Rocklath for new partition and metal lath for repairing.
2. Patch old register holes.
3. Make modern kitchen. See Plate 2A.
- a) Relocate rear door.
- b) Take off wainscot and put linoleum on walls.
- c) Repair floor and put down linoleum.
- d) Repair ceiling.
- e) Fur down for cabinets.
- f) Install ventilation fan as shown.
- g) Install new cabinets and fixtures.
- h) Install Andersen casement window.
- i) Patch old register hole.
- j) Provide 8" partition for soil pipe.

4. Put down linoleum in hall to kitchen.
5. Make modern dining room. See Plate 2A.
 - a) Remove small rooms and windows.
 - b) Remove old fireplace.
 - c) Remove old bay windows.
 - d) Install mill-made china cabinet.
 - e) Relocate swing door.
 - f) Install French doors to terrace.
 - g) Install window in east wall.
 - h) Install plastered arch to powder room hall.
 - i) Repair and sand floor for carpet. Patch register hole.
 - j) Repair plaster and trim.
6. Make powder room. See Plate 2A.
 - a) Plan hall for access to and from living and dining rooms.
 - b) Repair floor for linoleum.
 - c) Repair hall floor for carpet.
 - d) Install fixtures—water closet, lavatory, and medicine cabinet.
 - e) Provide new door.
 - f) Install new window.
 - g) Repair plaster for paper.
 - h) Repair woodwork.
7. Make new closet off hall near chimney.
 - a) Provide rod and shelves.
 - b) Patch floor for linoleum.
 - c) Patch plaster for painting.
 - d) Provide new door.
8. Remodel closet under stairs.
 - a) Provide new door.
 - b) Patch and sand floor for linoleum.
 - c) Patch plaster for painting.

Second-Floor Remodeling. See Plate 3A.

1. Remodel bedroom 1.
 - a) Cut down size (north end) about 3'0" to make space for new bathroom 2.
 - b) Cut down old closet size to make room for new bathroom 2.
 - c) Make small entry hall.
 - d) Relocate old closet door to bathroom 2.
 - e) Patch and sand floor for linoleum.
 - f) Patch old register hole.
 - g) Patch plaster for papering.
 - h) Renail trim.
 - i) Use Rocklath for new plaster and metal lath for repairing.
2. Repair bedroom 2. See Plate 3A.
 - a) Patch and sand floors for linoleum.
 - b) Patch plaster for papering.
 - c) Renail trim.
 - d) Patch register hole.
3. Remodel bedroom 3. See Plate 3A.
 - a) Reduce size about 2'0" (south side) to make room for enlarging old bathroom.

- b) Relocate door.
- c) Patch and sand floors for linoleum.
- d) Patch plaster for papering.
- e) Renail trim.
- f) Patch register hole.
- g) Use Rocklath for new plaster and metal lath for repairing.
- 4. Remodel bedroom 4. See Plate 3A.
 - a) Relocate windows from same room.
 - b) Use old closet door for bathroom.
 - c) Relocate window from living room.
 - d) Patch and sand floor for linoleum.
 - e) Patch plaster for papering.
 - f) Patch register hole.
 - g) Renail trim.
- 5. Remodel bathroom 1. See Plate 3A.
 - a) Enlarge by taking 2'0" from bedroom 3.
 - b) Provide recess for tub.
 - c) Provide access door to tub plumbing.
 - d) Provide 8" partition for soil pipe.
 - e) Install new fixtures—tub with shower, water closet, lavatory, and medicine cabinet.
 - f) Make tile floors and walls.
 - g) Patch ceiling plaster for painting.
 - h) Renail trim.
 - i) Use Rocklath for new plaster and metal lath for repairing.
 - j) Provide tile accessories.
- 6. Make new bathroom 2. See Plate 3A.
 - a) Make floor area required from space taken from bedroom 1 and the old large closets for bedrooms 1 and 4.
 - b) Install shower stall.
 - c) Install new fixtures—water closet, lavatory, and medicine cabinet.
 - d) Make tile floor and walls.
 - e) Renail trim.
 - f) Provide doors to bedrooms 1 and 4.
 - g) Patch ceiling plaster for painting.
 - h) Provide new window.
 - i) Provide tile accessories.
- 7. Remodel closet for bedroom 1. See Plate 3A.
 - a) Reduce size.
 - b) See Chapter III for hardware.
 - c) Provide shelf and rod.
 - d) Provide new door.
 - e) Patch and sand floor for linoleum.
 - f) Patch plaster for painting.
 - g) Use Rocklath for new plaster and metal lath for repairing.
- 8. Make closet for bedroom 2. See Plate 3A.
 - a) Use space taken by old stairwell.
 - b) Provide shelf and rod.
 - c) Provide new door.

- d) See Chapter III for hardware.
- e) Lay 1x4-inch fir over new rough floor. Prepare for linoleum.
- f) Use same trim as in room.
- 9. Make new closet for bedroom 3. See Plate 3A.
- a) Use part of space not required for bathtub recess.
- b) Provide new door.
- c) Patch and sand floor for linoleum.
- d) Use Rocklath for new plaster and metal lath for repairing.
- e) See Chapter III for hardware.
- f) Provide shelf and rod.
- g) Use same trim as in room.
- 10. Remodel closet for bedroom 4. See Plate 3A.
- a) Reduce size.
- b) See Chapter III for hardware.
- c) Provide shelf and rod.
- d) Relocate door.
- e) Patch and sand floor for linoleum.
- f) Use Rocklath for new plaster and metal lath for repairing.
- 11. Provide towel closet in bathroom 1. See Plate 3A.
- a) Use part of space taken from bedroom 3 and not required by closet for that room.
- b) Provide six shelves.
- c) Provide new door.
- d) Use Rocklath for new plaster.
- 12. Provide linen closet. See Plate 3A.
- a) Use part of space not required for closet in bedroom 2.
- b) Provide 7 shelves.
- c) Provide new door.
- d) Lay 1x4-inch fir over new rough floor. Prepare for linoleum.
- e) Use same trim as in other areas.

Third-Floor Remodeling. See Plate 4A.

- 1. Make new bedroom in south half of attic space. See Plate 4A.
- a) Apply 1x4-inch fir over old rough floor. Prepare for linoleum.
- b) Use Rocklath for new plaster.
- c) Use same trim as on other floors.
- d) Provide door to hall.
- e) Use existing windows and locations.
- 2. Make bathroom 3. See Plate 4A.
- a) Apply 1x4-inch fir over old rough floor. Prepare for linoleum.
- b) Use Rocklath for new plaster.
- c) Apply linoleum to walls.
- d) Install shower stall.
- e) Install new fixtures—water closet, lavatory, and medicine cabinet.
- f) Provide new door.
- g) Use existing window.
- 3. Make new closet. See Plate 4A.
- a) Provide new door.
- b) Use Rocklath for new plaster.
- c) Apply 1x4-inch fir over old rough floor. Prepare for linoleum.

- d) Provide shelves and clothes rod.

Hall Remodeling. See Plates 1A, 2A, 3A, and 4A.

1. Make basement hall at foot of stairs connect with playroom and laundry and furnace room areas. See Plate 1A.

- a) Lay 1x4-inch fir over sleepers. Prepare for linoleum.
- b) Provide one new door.
- c) Make plastered opening into playroom.
- d) Use Rocklath for new plaster.
- e) Use same trim as on first floor.

2. Retain first-floor central hall. See Plate 2A.

- a) Remodel south end and make plastered arch into living room.
- b) Use metal lath for arch and repairing of plaster.
- c) Patch and sand floor for linoleum.
- d) Patch plaster for papering.
- e) Renail trim.

3. Retain second-floor hall. See Plate 3A.

- a) Remodel north end.
- b) Use Rocklath for new plaster and metal lath for repairing.
- c) Patch and sand floors for linoleum.
- d) Patch plaster for papering.
- e) Renail trim.

4. Make third-floor hall at top of stairs to connect with new bedroom and unfinished area.

- a) Provide new door.
- b) Apply 1x4-inch fir over old rough floor and prepare for linoleum.
- c) Use same trim as in other parts of house.
- d) Use Rocklath for new plaster and prepare for papering.

Elevation Remodeling. See Plates 5A through 8A.

The details for elevation remodeling are not outlined as for room and floor plan remodeling. However, you can study the remodeled elevations in Plates 5A through 8A and easily write the details yourself. From the studies made in previous steps and the remodeling shown in the blueprints, you will be able to note the small amount of elevation remodeling, detail by detail.

Step 7. Insulation. Insulation should be applied as a means of retarding heat loss during the winter and heat gain during the summer. The specifications in Chapter III set forth where insulation is to be used and the kind. These directions check with the principles given in Chapter IX.

Step 8. Structural Details. The structural details were designed or planned largely in accordance with the principles explained in Chapter VII.

Beams. The new 8-inch I beam over the playroom was selected because its top and bottom would be flush with the tops of the joists and would not extend below the joists, thus saving head room. It replaced old wood girders and posts which were in bad condition. The beam was designed following instructions in Chapter VII.



Fig. 313. Jones House After Remodeling



Fig. 314. Main Stairway After Remodeling

The Flitch girder used over the living room takes the place of an old bearing partition. It was designed in accordance with instructions in Chapter VII.

Column. The new pipe column (lally) in the basement was selected from the manufacturer's catalog. A 4-inch column is sufficient for any residential purpose.

Joists. The joist strengths were calculated following instructions in Chapter VII.



Fig. 315. Remodeled Kitchen in the Jones House

Miscellaneous Framing. All framing around openings was designed in accordance with instructions in Chapter VII.

Areaways. The areaway retaining walls are composed of corrugated sheet steel. This can be purchased ready to install.

Step 9. Electrical Work. The designing of the electrical work for the Jones house is explained in detail in Chapter XIV.

Step 10. Heating and Air Conditioning. The designing of the gas-fired winter air-conditioning system for the remodeled Jones house is explained in Chapter XIII.

Step 11. Decorating. The details of decorating are outlined in the specifications in Chapter III in order to show how specifications are prepared, and the items ordinarily considered.

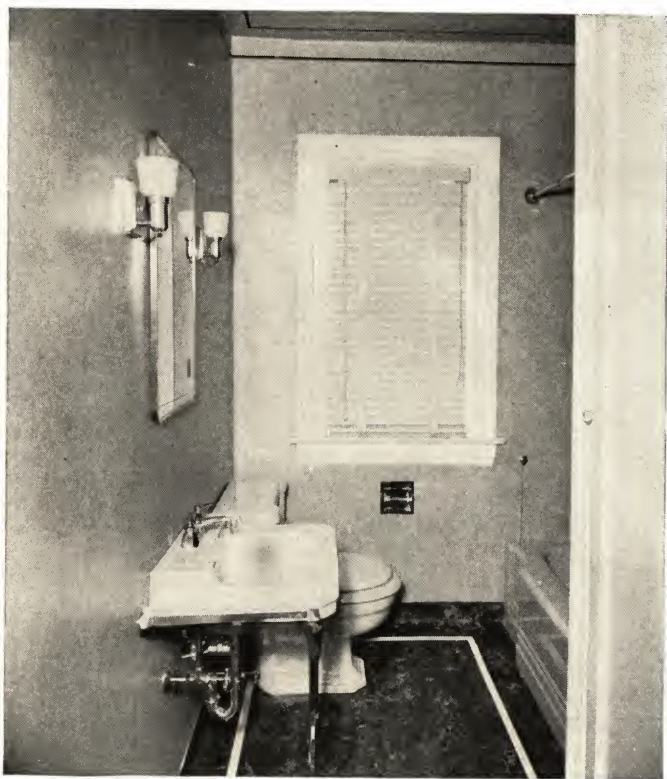


Fig. 316. Bathroom 1 of the Jones House After Remodeling

Step 12. Miscellaneous Items. There are always some miscellaneous items to be considered in any remodeling job. They are noted, ordinarily, as the planning progresses.

Hardware. To list every item of hardware required would be tedious and almost impossible. A stipulated amount of money is allowed, as explained in Chapter III, and the contractor is instructed to make such repairs and supply such new items as may be necessary.

Weather Stripping. As explained in Chapter IX, it is important that weather stripping be applied to all exterior doors and windows.

Sidewalk. A new section of concrete sidewalk is required between the new front porch steps and the driveway.

Driveway. A few squares in the driveway need patching.

Millwork. The new doors, windows, French doors, china cabinet, closet equipment, and similar features are all listed under millwork. They should be



Fig. 317. New Bathroom 2 in the Jones House

selected from standard stocks, for reasons previously explained.

Linoleum and Carpeting. The patterns and the quality will be selected by Mrs. or Mr. Jones.

Step 13. Specifications. The making of specifications should be carried on as explained in Chapters II and III.

THE REMODELED JONES HOUSE. In the following paragraphs, a few features of the remodeling results are discussed:

Exterior. Fig. 313 shows a view of the Jones house after the remodeling was completed. Compare this picture with the one shown in Fig. 305 and note the decided improvement made by redesigning the front porch, relocating windows and doors, and repainting. The house now has a modern effect; at the same time it does not differ too greatly from the other houses in the neighborhood.

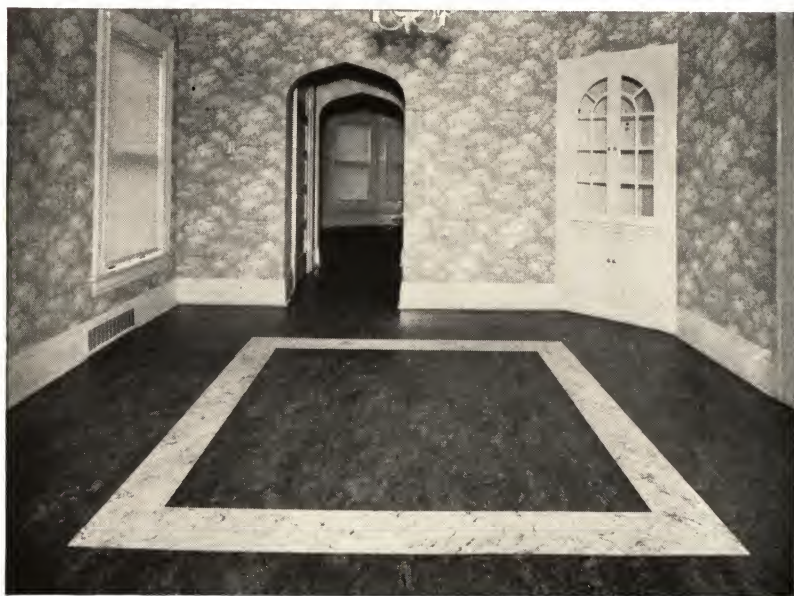


Fig. 318. Remodeled Dining Room of the Jones House

Main Stairs. Fig. 314 shows the new stairs between the remodeled living room and the landing. Compare this picture with the one in Fig. 307. Note what a modern effect was produced by the remodeling. This feature alone has added a great deal to the remodeled house by changing a drab uninteresting stairway to one having color and life.

Kitchen. Fig. 315 shows the remodeled kitchen. The new linoleum, cabinets, windows, lights, range, and sink all help to make this kitchen inviting as well as efficient. The new sink cabinet, especially, is a far cry from the old sink shown in Fig. 311.

Bathroom 1. Fig. 316 shows bathroom 1 after remodeling. Com-

pare the fixtures with those shown in Fig. 312. The remodeled bathroom is beautiful and easily kept clean, a pleasing contribution to the total effect of the house.

Bathroom 2. Fig. 317 shows the new bathroom on the second floor. The tile floors and walls, with modern fixtures and lighting, help make this beautiful room a distinct addition to the value of the house.

Dining Room. Fig. 318 shows the attractive dining room that resulted from the remodeling. The new floor covering, the new wall paper, repainted trim, corner china cabinet, and arched openings to the powder and living rooms are simple improvements, but their total effect is charming.

CONCLUSION. If this book has inspired you with burning zeal to remodel a house, perhaps it has also convinced you that to be sure of success you must plan any remodeling job, be it large or small, with all the care and detailed attention outlined, explained, and illustrated throughout the foregoing chapters and pages.



A CAPE COD HOUSE DESIGNED STRICTLY IN KEEPING WITH THE TRADITIONS OF THE STYLE
Courtesy of Curtis Companies, Incorporated, Manufacturers of Curtis Woodwork, Clinton, Iowa

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